Draft U.S. Pacific Marine Mammal Stock Assessments: 2005

by

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NOAA-TM-NMFS-SWFSC Technical Memorandum

U. S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Fisheries Science Center

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Stock assessment reports and appendices revised in 2005 are highlighted; all others are reprinted as they appear in the 2004 Pacific Region Stock Assessment Reports (Carretta *et al.* 2004).

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PREFACE

Under the 1994 amendments to the Marine Mammal Protection Act (MMPA), the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) are required to publish Stock Assessment Reports for all stocks of marine mammals within U.S. waters, to review new information every year for strategic stocks and every three years for non-strategic stocks, and to update the stock assessment reports when significant new information becomes available. This report presents revised stock assessments for 5 Pacific marine mammal stocks under NMFS jurisdiction: 1) the California stock of harbor seals 2) Hawaiian monk seal 3) Eastern North Pacific humpback whale 4) Hawaii false killer whale 5) Southern Resident killer whale and 6) the California/Oregon/Washington stock of short-finned pilot whale. Information on the remaining 56 Pacific region stocks is reprinted without revision in this report and also appears in the 2004 reports (Carretta *et al.* 2005). Stock Assessments for Alaskan marine mammals are published by the National Marine Mammal Laboratory (NMML) in a separate report.

The five revised stock assessments in this report include those studied by the Southwest Fisheries Science Center (SWFSC, La Jolla, California), the Pacific Islands Fisheries Science Center (PIFSC, Honolulu, Hawaii), and the National Marine Mammal Laboratory (NMML, Seattle, Washington). Staff of the Alaska Fisheries Science Center prepared the report on the Eastern North Pacific Southern Resident killer whale. Pacific Islands Fisheries Science Center staff prepared the report on the Hawaiian monk seal. Southwest Fisheries Science Center staff prepared stock assessments for the remaining four stocks. Updated estimates of abundance are available for California harbor seals (Lowry et al. 2005), Eastern North Pacific humpback whales (Calambokidis et al. 2004), Southern Resident killer whales, and Hawaiian monk seals. Updated calculations of potential biological removal (PBR) are available for California harbor seals, Eastern North Pacific humpback whales, and Hawaiian false killer whales.

New information on U.S. commercial fisheries that may interact with marine mammals is presented in Appendix 1. We thank Chris Yates for reviewing and providing input on the Hawaii pelagic longline fishery update.

Earlier versions of these stock assessment reports were reviewed by the Pacific Scientific Review Group in January 2005. The authors also wish to thank those who provided unpublished data, especially Robin Baird and Joseph Mobley, who provided valuable information on Hawaiian cetaceans. Any omissions or errors are the sole responsibility of the authors.

This is a working document and individual stock assessment reports will be updated as new information becomes available and as changes to marine mammal stocks and fisheries occur. Background information and guidelines for preparing stock assessment reports are reviewed in Wade and Angliss (1997). The authors solicit any new information or comments which would improve future stock assessment reports.

These Stock Assessment Reports summarize information from a wide range of sources and an extensive bibliography of all sources is given in each report. We strongly urge users of this document to refer to and cite original literature sources rather than citing this Stock Assessment Report. If the original sources are not available, the citation should follow the format: [Original citation], as cited in [this Stock Assessment Report citation].

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Revised ~~12/15/2003~~ 05/01/2005

HARBOR SEAL (*Phoca vitulina richardsi*): California Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Harbor seals (*Phoca vitulina*) are widely distributed in the North Atlantic and North Pacific. Two subspecies exist in the Pacific: *P. v. stejnegeri* in the western North Pacific, near Japan, and *P. v. richardsi* in the eastern North Pacific. The latter subspecies inhabits near-shore coastal and estuarine areas from Baja California, Mexico, to the Pribilof Islands in Alaska. These seals do not make extensive pelagic migrations, but do travel 300-500 km on occasion to find food or suitable breeding areas (Herder 1986; D. Hanan unpublished data). In California, approximately 400-~~500~~600 harbor seal haulout sites are widely distributed along the mainland and on offshore islands, including intertidal sandbars, rocky shores and beaches (Hanan 1996; Lowry et al. 2004).

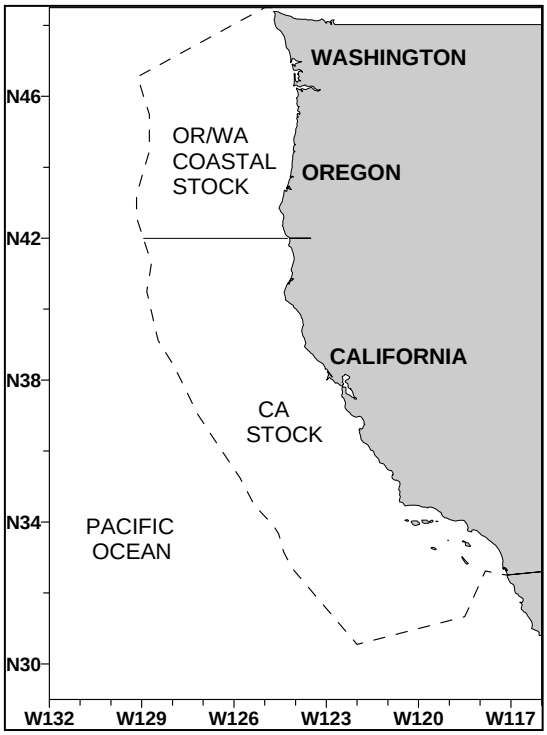


Figure 1. Stock boundaries for the California and Oregon/Washington coastal stocks of harbor seals. Dashed line represents the U.S. EEZ.

Within the subspecies *P. v. richardsi*, abundant evidence of geographic structure comes from differences in mitochondrial DNA (Huber et al. 1994; Burg 1996; Lamont et al. 1996; Westlake and O'Corry-Crowe 2002; O'Corry-Crowe et al. 2003), mean pupping dates (Temte 1986), pollutant loads (Calambokidis et al. 1985), pelage coloration (Kelly 1981) and movement patterns (Jeffries 1985; Brown 1988). LaMont (1996) identified four discrete subpopulation differences in mtDNA between harbor seals from Washington (two locations), Oregon, and California. Another mtDNA study (Burg 1996) supported the existence of three separate groups of harbor seals between Vancouver Island and southeastern Alaska. Although we know that geographic structure exists along an almost continuous distribution of harbor seals from California to Alaska, stock boundaries are difficult to draw because any rigid line is (to a greater or lesser extent) arbitrary from a biological perspective. Nonetheless, failure to recognize geographic structure by defining management stocks can lead to depletion of local populations. Previous assessments of the status of harbor seals have recognized three stocks along the west coast of the continental U.S.: 1) California, 2) Oregon and Washington outer coast waters, and 3) inland waters of Washington. Although the need for stock boundaries for management is real and is supported by biological information, the exact placement of a boundary between California and Oregon was largely a political/jurisdictional convenience. An unknown number of harbor seals also occur along the west coast of Baja California, at least as far south as Isla Asuncion, which is about 100 miles south of Punta Eugenia. Animals along Baja California are not considered to be a part of the California stock because it is not known if there is any demographically significant movement of harbor seals between California and Mexico and there is no international agreement for joint management of harbor seals. Lacking any new information on which to base a revised boundary, the harbor seals of California will be again treated as a separate stock in this report (Fig. 1). Other Marine Mammal Protection Act (MMPA) stock assessment reports cover the five other stocks that are recognized along the U.S. west coast: Oregon/Washington outer coastal waters, Washington inland waters, and three stocks in Alaska coastal and inland waters.

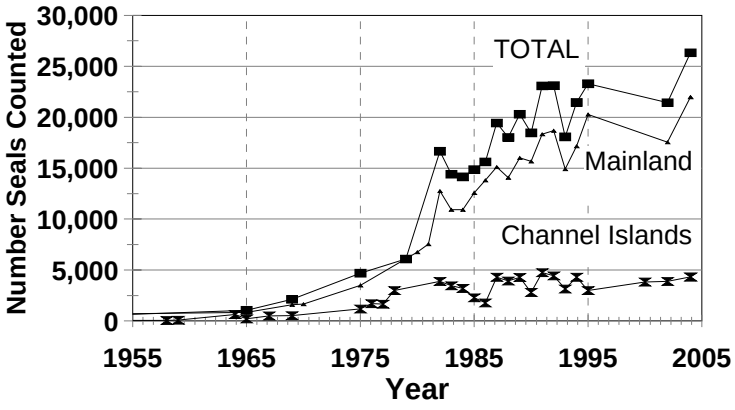
POPULATION SIZE

A complete count of all harbor seals in California is impossible because some are always away from the haulout sites. A complete pup count (as is done for other pinnipeds in California) is also not possible because harbor seals are precocious, with pups entering the water almost immediately after birth.

Population size is estimated by counting the number of seals ashore during the peak haul-out period (May to July) and by multiplying this count by the inverse of the estimated fraction of seals on land. Boveng (1988) reviewed studies estimating the proportion of seals hauled out to those in the water and suggested that a correction factor for harbor seals is likely to be between 1.4 and 2.0. Huber (1995) estimated a mean correction factor of 1.53 (CV=0.065) for harbor seals in Oregon and Washington during the peak pupping season. Hanan (1996) estimated that 83.3% (CV=0.17) of harbor seals haul out at some time during the day during the May/June molt, and he estimated a correction factor of 1.20 based on those data. Neither correction factor is directly applicable to an aerial photographic count in California: the 1.53 factor was measured at the wrong time of year (when fewer seals are hauled out) and in a different area and the 1.20 factor was based on the fraction of seals hauled out over an entire 24-hour day (correction factors for aerial counts should be based on the fraction of seals hauled out at the time of the survey). Hanan (pers. comm.) revised his haul-out correction factor to 1.3 by using only those seals hauled out between 0800 and 1700 hrs which better corresponds to the timing of his surveys. Based on the most recent harbor seal counts (~~21,433~~ 26,333 in May-July ~~2002~~2004; ~~Lowry and Carretta, 2003~~Lowry et al. 2004) and Hanan's revised correction factor, the harbor seal population in California is estimated to number ~~27,863~~ 34,233.

Minimum Population Estimate

Because of the way it was calculated (based on the fraction of seals hauled out at any time during a 24 hr day), Hanan's (1996) correction factor of 1.2 can be viewed as a minimum estimate of the fraction hauled out at a given instant. A population size estimated using this correction factor provides a reasonable assurance that the true population is greater than or equal to that number, and thus fulfills the requirement of a minimum population estimate. The minimum size of the California harbor seal population is therefore ~~25,720~~ 31,600.



May/June (Hanan 1996; R. Read, CDFG unpubl. data; NMFS unpubl. data from 2002 and 2004 surveys).

Current Population Trend

Counts of harbor seals in California showed a rapid increase from approximately 1972 (when the MMPA was first passed) to 1990 (Fig. 2). Net production rates appeared to be decreasing from 1982 to 1994 (Fig. 3). ~~Since 1990 there has been no net population growth along the mainland or on the Channel Islands.~~ Although earlier analyses were equivocal (Hanan 1996) and there has been no formal determination that the California stock has reached OSP (Optimal Sustainable Population level as defined by the MMPA), the decrease in population growth rate has occurred at the same time as a decrease in human-caused mortality and may indicate that the population ~~has reached~~ is approaching its environmental carrying capacity. Population growth has also slowed or stopped for the harbor seal stock on the outer coasts of Oregon and Washington (see separate Stock Assessment Report).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A realized rate of increase was calculated for the 1982-1995 period (when annual counts were available) by linear regression of the natural logarithm of total count versus year. The slope of this regression line was 0.035 (s.e.=0.007) which gives an annualized growth rate estimate of 3.5%. The current rate of net production is greater than this observed growth rate because fishery mortality takes a fraction of the net production. Annual gillnet mortality may have been as high as 5-10% of the California harbor seal population in the mid-1980s; a kill this large would have depressed population growth rates appreciably. Net productivity was therefore calculated for 1980-1994 as the realized rate of population growth (increase in seal counts from year *i* to year *i*+1, divided by the seal count in year *i*) plus the human-caused mortality rate (fishery mortality in year *i* divided by population size in year *i*). Between 1983 and

1994, the net productivity rate for the California stock averaged 9.2% (Fig. 3). A regression shows a decrease in net production rates, but the decline is not statistically significant. Maximum net productivity rates cannot be estimated because measurements were not made when the stock size was very small.

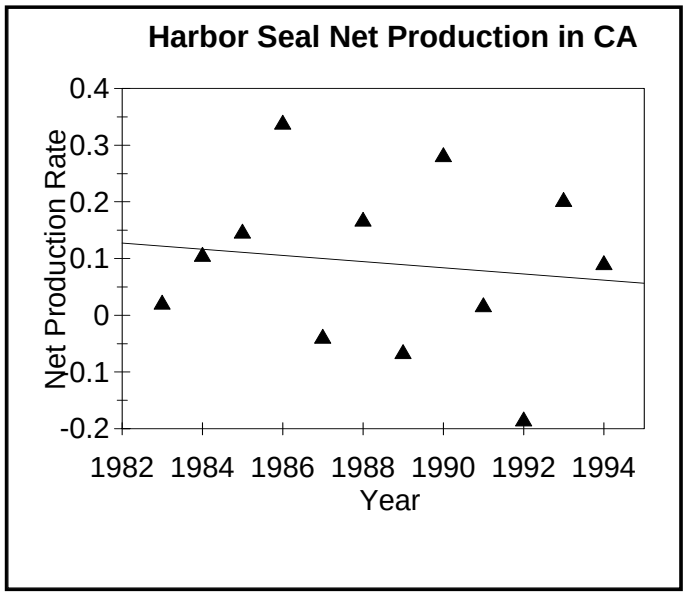


Figure 3. Net production rates and regression line estimated from haulout counts and fishery mortality.

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for this stock is calculated as the minimum population size (~~25,720~~ 31,600) times one half the default maximum net productivity rate for pinnipeds (½ of 12%) times a recovery factor of 1.0 (for a stock of unknown status that is growing or for a stock at OSP, Wade and Angliss 1997), resulting in a PBR of ~~1,543~~ 1,896.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Historical Takes

Prior to state and federal protection and especially during the nineteenth century, harbor seals along the west coast of North America were greatly reduced by commercial hunting (Bonnot 1928, 1951; Bartholomew and Boolootian 1960). Only a few hundred individuals survived in a few isolated areas along the California coast (Bonnot 1928). In the last half of this century, the population has increased dramatically.

Fishery Information

A summary of known fishery mortality and injury for this stock of harbor seals is given in Table 1. More detailed information on these fisheries is provided in Appendix 1. Because the vast majority of harbor seal mortality in California fisheries occurs in the set gillnet fishery, because that fishery has undergone dramatic reductions and redistributions of effort, and because the entire fishery has not been observed since 1994, average annual mortality cannot be accurately estimated for the recent years (~~1997-2001~~ 1999-2003). Rough estimates for ~~1997-2001~~ 1999-2003 have been made by extrapolation of prior kill rates using recent effort estimates and observations in the Monterey portion of the fishery from 1999 and 2000 (Table 1). Observations from the Monterey Bay portion of the fishery included 57 and 24 harbor seals taken in 1999 and 2000, respectively. Stranding data reported to the California Marine Mammal Stranding Network in ~~1997-2000~~ 1999-2003 include harbor seal deaths and injuries caused by hook-and-line fisheries (~~nine~~ four deaths, ~~four~~ two injuries) and gillnet fisheries (~~three~~ two deaths, ~~three~~ two injuries). The locations and timing of harbor seal strandings attributed to gillnet fisheries suggest that the halibut/angel shark or white seabass set gillnet fishery are responsible for the interactions (see Appendix 1 for fishery descriptions).

Other Mortality

The California Marine Mammal Stranding database maintained by the National Marine Fisheries Service, Southwest Region, contains the following records of human-related harbor seal mortalities and injuries in ~~1997-2000~~1999-2003: (1) boat collision (~~12~~ eight mortalities, two injuries), (2) entrainment in power plants (~~20~~26 mortalities), (3) shootings (~~five~~ 15 mortalities), and (4) all-terrain vehicle (ATV) collision (one injury).

Table 1. Summary of available information on the mortality and serious injury of harbor seals (California stock) in commercial fisheries that might take this species (~~NMFS 1995; Julian 1997; Julian and Beeson 1998;~~ Cameron and Forney ~~1999;~~ 2000; Carretta 2001, 2002; Carretta et al. 2003; Carretta and Chivers 2004). n/a indicates that data are not available. Mean annual takes are based on ~~1997-2001~~ 1999-2003 data unless noted otherwise.

Fishery Name	Year(s)	Data Type	Percent Observer Coverage	Observed Mortality	Estimated Mortality (CV in parentheses)	Mean Annual Takes (CV in parentheses)
CA/OR thresher shark/swordfish drift gillnet fishery	~~1997-2001~~ 1998-2003	observer data	20-23%	0	0,0,0,0,0	0[1]
CA angel shark/halibut and other species large mesh (>3.5") set gillnet fishery	~~1997~~ ~~1998~~ 1999 2000 2001 2002 2003	~~extrapolated estimate~~ observer data extrapolated estimate	~~0.0%~~ ~~0.0%~~ 4.0%[3] 1.7%[3] 0.0%[3] 0.0%[3] 0.0%[3]	- - 57 24 - - -	~~349 (0.08)~~[1] ~~392 (0.10)~~[1] 662 (0.10)[1] 415 (0.08)[1] 329 (0.09)[1] 337 (0.11)[1] 186 (0.09)[1]	~~429 (0.04)~~[1] 386 (0.05)[1]
CA, OR, and WA salmon troll fishery	1990-92	logbook data	-		Avg. Annual take = 7.33	N/a
CA herring purse seine fishery	1990-92	logbook data	-		Avg. Annual take = 0	N/a
CA anchovy, mackerel, and tuna purse seine fishery	1990-92	logbook data	-		Avg. Annual take = 0.67	N/a
WA, OR, CA groundfish trawl	~~1997~~ ~~1998~~ 1999 2000 2001 2002 2003 ~~1997-2001~~ 1999-2003	observer data unmonitored hauls	~~65.7%~~ ~~77.3%~~ 68.6% 80.6% 96.2% ? ?	~~0~~ ~~0~~ 0 2 0 0 0 1	~~0~~ ~~0~~ 0 ~~3 (0.21)~~2.2 0 0 0 1	~~0.6 (0.21)~~ 0.44 (0.21) ~~0.2 (n/a)~~
CA squid purse seine fishery	1997-2001	logbook data	Warden obs 2-3 trips/month	0	Avg. Annual take = 0	n/a
(unknown net and hook fisheries)	~~1997-2000~~ 1999-2003	stranding data		~~12~~ 6		~~3~~ 1.5
Total annual takes						~~433 (0.04)~~ 388 (0.05)

[1]The CA set gillnets were not observed after 1994, except for Monterey Bay, where the fishery was observed in 1999 and 2000. Mortality in other regions was extrapolated from current (~~1997-2001~~ 1999-2003) effort estimates and 1990-94 entanglement rates,

thus the CV of the mortality estimate for this fishery is likely to be underestimated by an unknown amount. There was no observer coverage in this fishery in 2001-2003.

STATUS OF STOCK

A review of harbor seal dynamics through 1991 concluded that their status relative to OSP could not be determined with certainty (Hanan 1996). They are not listed as "endangered" or "threatened" under the Endangered Species Act nor as "depleted" under the MMPA. Total fishing mortality cannot be accurately estimated for recent years, but extrapolations from past years indicate that fishing mortality (~~433~~ 388 per year) is less than the calculated PBR for this stock (~~1,543~~ 1,896), and thus they would not be considered a "strategic" stock under the MMPA. The average rate of incidental fishery mortality for this stock is likely to be greater than 10% of the calculated PBR; therefore, fishery mortality cannot be considered insignificant and approaching zero mortality and serious injury rate. The population appears to be stabilizing at what may be their carrying capacity and the fishery mortality is declining. There are no known habitat issues that are of particular concern for this stock. Two unexplained harbor seal mortality events occurred in Point Reyes National Park involving at least 90 seals in 1997 and 16 seals in 2000. Necropsy of three seals in 2000 showed severe pneumonia; tests for morbillivirus were negative, but attempts are being made to identify another virus isolated from one of the three (F. Gulland, pers. comm.). All west-coast harbor seals that have been tested for morbilliviruses were found to be seronegative, indicating that this disease is not endemic in the population and that this population is extremely susceptible to an epidemic of this disease (Ham-Lammé et al. 1999).

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HAWAIIAN MONK SEAL (*Monachus schauinslandi*)

STOCK DEFINITION AND GEOGRAPHIC RANGE

Hawaiian monk seals are distributed throughout ~~the Northwestern~~ Hawaii~~an Islands (NWHI)~~ predominantly in six ~~main~~ Northwestern Hawaiian Islands (NWHI) ~~reproductive~~ subpopulations at French Frigate Shoals, Laysan and Lisianski Islands, Pearl and Hermes Reef, and Midway and Kure Atoll. Small numbers also occur at Necker, Nihoa, and the main Hawaiian Islands (MHI~~, primarily at Niihau~~. Genetic variation among NWHI monk seals is extremely low and may reflect both a long-term history at low population levels and more recent human influences (Kretzmann et al. 1997, 2001). On average, 10-15% of the seals migrate among the NWHI subpopulations (Johnson and Kridler 1983; Harting 2002). Thus, the NWHI subpopulations are not ~~demographically~~ isolated, though the different island subpopulations have exhibited considerable demographic independence. ~~For example, abundance at French Frigate Shoals grew rapidly from the 1950s-1980s, while other subpopulations declined rapidly.~~ Observed interchange of individuals among the NWHI and MHI regions is extremely rare, suggesting these may be more appropriately designated as separate stocks. Further evaluation of a separate MHI stock will be pursued following genetic stock structure analysis (currently underway) and additional ~~population assessment and~~ studies ~~of movements~~ of MHI monk seals ~~in the MHI~~. In the mean time, ~~while research and recovery activities may focus on the problems of single island/atoll subpopulations,~~ the species is managed as a single stock.

POPULATION SIZE

The best estimate of the total population size is 1,252 ~~1,304~~. This estimate is the sum of counts at the six main Northwest Hawaiian Islands subpopulations, an extrapolation of counts at Necker and Nihoa Islands, and counts at the main Hawaiian Islands. Abundance of the main reproductive subpopulations is currently ~~best~~ estimated using the number of seals identified at each site, though efforts to develop improved methods are underway (Baker 2004, Baker et al. in review). Individual seals are identified by flipper-tags and applied bleach-marks, and distinctive natural features such as scars and pelage patterns. ~~Flipper tagging of weaned pups began in the early 1980s and the majority of the seals in the main reproductive subpopulations can be identified on the basis of those tags.~~ In ~~2002~~2003, identification efforts were conducted during two- to six-month studies at all main reproductive sites. A total of 1,100~~1,156~~ seals (including 180~~196~~ pups) were observed at the main reproductive subpopulations in ~~2002~~2003 (Johanos and Baker, in press). The estimated probability that known-aged seals are identified during a given field season average over 90% at French Frigate Shoals, Laysan Island, Midway Atoll and Kure atoll; approximately 85% at Lisianski Island, and approximately 80% at Pearl and Hermes Reef (Harting 2002). These probabilities likely represent the potential extent of negative bias in enumerating the subpopulations.

Monk seals also occur at Necker and Nihoa Islands, where counts are conducted from zero to a few times in a single year. Abundance is estimated by correcting the mean of all beach counts accrued over the past five years. The mean (±SD) of all counts (excluding pups) conducted between ~~1998-2002~~1999-2003 were 16.4 (±6.9) at Necker Island and 17.0~~15.4~~ (±7.6~~7.3~~) at Nihoa Island (Johanos and Ragen 1999; Johanos and Baker 2000, 2001, 2002, 2004, in press). The relationship between mean counts and total abundance at the reproductive sites indicates that the total abundance can be estimated by multiplying the mean count by a correction factor (±SE) of 2.89 (±0.06, NMFS unpubl. data). Resulting estimates (plus the average number of pups known to have been born during 1997-2001) are 48.5 ~~48.3~~ (± 19.9~~18.5~~) at Necker Island and 51.7~~47.3~~ (± 22.1~~21.1~~) at Nihoa Island.

A 2001 aerial survey determined a minimum abundance of 52 seals in the MHI and remains the most recent available estimate (Baker and Johanos 200~~3~~). Seals in the MHI include those naturally occurring and any animals remaining from 21 seals translocated from the NWHI ~~released around the islands~~ in 1994.

Minimum Population Estimate

The total number of seals identified at the six main NWHI reproductive sites is the best estimate of minimum population size at those sites (i.e., 1,100~~1,156~~ seals). Minimum population sizes for Necker and Nihoa Islands (based on the formula provided by Wade and Angliss (1997) are 35 and 37 ~~33~~, respectively. The minimum abundance estimate for the main Hawaiian Islands based upon the 2001 aerial survey is 52 seals. The minimum population size for the entire stock (species) is the sum of these estimates, or 1,224~~1,276~~ seals.

Current Population Trend

The total of mean non-pup beach counts at the six main reproductive NWHI subpopulations in ~~2002~~2003 is approximately 60% lower than in 1958. ~~Counts declined from 1985 to 1993, then became rather stable. As a result, a log-linear trend through the entire time series results in lack of fit. To remedy this, a~~ A log-linear broken-line regression (two ~~regression~~ lines joined at a break point) is fitted with the break point chosen to minimize the sum of squares error[1]. This method estimates that the total counts declined 4.2% yr^{-1} until 1993, then declined at 1.9~~1.1~~% yr^{-1} thereafter (Fig. 1). The broken line regression fit significantly better than a single regression line (p = 0.05 ~~0.03~~). Thus, current population trend is ~~best~~ estimated as -1.9~~1.1~~ yr^{-1} (95% CI = -3.0~~2.4~~% to –0.9 ~~0.2~~% yr^{-1}).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

~~Assuming~~ Using mean beach counts as a long-term ~~are a reliable~~ index of total abundance, the current net productivity rate for this species is –0.019 ~~-0.011~~ yr^{-1} (see above). Trends in abundance vary considerably among the six main subpopulations. For example, the decline since the mid-1980's (Fig. 1) was largely due to a severe decline at French Frigate Shoals, where non-pup beach counts decreased by 7% from 1989-~~2002~~2003. Populations at Laysan and Lisianski Islands have remained relatively stable since approximately 1990, though the former has tended to increase slightly while the latter has decreased slowly.

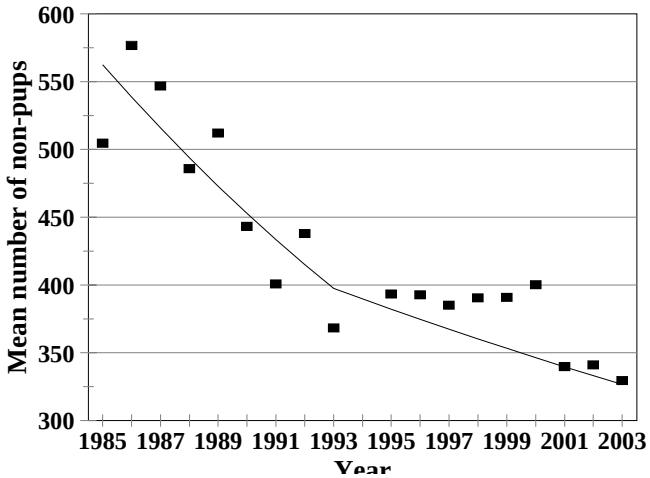

Figure 1. Mean beach counts of Hawaiian monk seals at the six main NWHI subpopulations, 1985-~~2002~~2003.

Until recently, the three westernmost subpopulations, Kure, Midway and Pearl and Hermes Reef exhibited substantial growth. The subpopulation at Kure Atoll grew at an average rate of 5% yr^{-1} from 1983 to 2000 (loglinear regression of beach counts; R^2 = 0.85, p<0.001), due largely to decreased human disturbance and introduced females. However, since 2000, counts at Kure have declined coinciding with very low survival of the 2000-200~~2~~1 cohorts from weaning to age 1 yr (15% to 22%~~and 18%, respectively~~). The subpopulation at Pearl and Hermes Reef increased after the mid-1970s. The average growth rate from 1983-2000 was 6%yr^{-1} (loglinear regression of beach counts; R^2 = 0.84, P<0.001), and prior to 1999, growth rates of up to 7%yr^{-1} were observed. This is the highest estimate of the maximum net productivity rate (R_{max}) observed for this species. Growth of this subpopulation has slowed recently and early survival has declined. Recovery of the small subpopulation at Midway Atoll appears to have slowed or stopped, also accompanied by relatively poor juvenile survival. These demographic trends at the western end of the NWHI do not bode well for recovery, especially if recent low juvenile survival rates become chronic. While the MHI monk seal population may be on the rise (Baker and Johanos 200~~3~~4), this remains unconfirmed and abundance appears to be too low to strongly influence current total stock trends.

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal (PBR) is designed to allow stocks to recover to, or remain above, the maximum net productivity level (MNPL) (Wade 1998). An underlying assumption in the application of the PBR equation is that marine mammal stocks exhibit certain dynamics. Specifically, it is assumed that a reduced stock will naturally grow toward OSP (Optimum Sustainable Population), and that some surplus growth could ~~can~~ be removed while still allowing recovery. The Hawaiian monk seal population is far below historical levels and has declined 1.9~~1.1~~% yr^{-1} on average for the past decade. Thus, for unknown reasons, the stock's dynamics do not conform to the underlying model for calculating PBR. The prescribed PBR calculation for this stock would be the minimum population size (1,224~~1,276~~) times one half the maximum net growth rate (½ of 7%) times a recovery factor of 0.1 (for an endangered species, Wade and Angliss 1997), which yields 4.3~~4.5~~ monk seals per year. However, given the stock's current status and trend, the intended standard for determining PBR, i.e., recovery to MNPL, will not be

[1] (B. Venables, s-news website, http://www.biostat.wustl.edu/mailinglists/s_news/200004/msg00212.html)

achieved in the foreseeable future if a take of 4.34.5 seals a year is realized. ~~Meanwhile, i~~It also appears unlikely that some non-zero level of removal below 4.34.5 animals could explain the lack of recovery of this stock. Given this unique set of circumstances, PBR for the Hawaiian monk seal is undetermined.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Human-related mortality has caused two major declines of the Hawaiian monk seal (Ragen 1999). In the 1800s, this species was decimated by sealers, crews of wrecked vessels, and guano and feather hunters (Dill and Bryan 1912; Wetmore 1925; Bailey 1952; Clapp and Woodward 1972). Following a period of at least partial recovery in the first half of the 20th century (Rice 1960), most subpopulations again declined. This second decline has not been fully explained, but trends at several sites appear to have been determined by human disturbance from military or U.S. Coast Guard activities (Ragen 1999; Kenyon 1972; Gerrodette and Gilmartin 1990). Currently, human activities in the NWHI are limited and human disturbance is relatively rare.

Fishery Information

Fishery interactions with monk seals include: operations/gear conflict, seal consumption of discarded fish, and competition for prey. Entanglement of monk seals in derelict fishing gear, which is believed to originate outside the Hawaiian archipelago, is described in a separate section below. Since 1976, four known fishery-related monk seal deaths have included the following (NMFS unpubl. data): one seal drowned in a nearshore gillnet off Kauai (1976), another seal died from entanglement in the bridle rope of lobster trap near Necker Island (1986), another died from entanglement in an illegally set gill net off Oahu (1994), and one ingested a fish hook and likely drowned off Kauai (1995). A total of 3126 seals have been observed with embedded fish hooks from ~~during~~ 1982 to 20022003. The hooks were not always recovered and it was not possible to attribute each hooking event to a specific fishery. Among hooks that could be identified, sources included ~~state-managed~~ nearshore fisheries (esp. for *Caranx* sp. in the MHI ~~main Hawaiian Islands~~) in State of Hawaii waters, ~~federal and state~~ bottomfish (handline) and ~~federal~~ longline fisheries in State and Federal waters (NMFS unpubl. data). A recent Biological Opinion summarized hookings and entanglements (NMFS 2002). ~~Importantly, t~~The majority of these deaths and injuries have been observed incidentall~~y~~ to ~~during~~ land-based research or other activities. Monk seal/fisheries interactions are not monitored in a manner such that ~~need to be monitored to assess~~ the rate of fisheries-related injury or mortality can be assessed ~~for this species~~.

Several ~~Four~~ fisheries have potential to interact with Hawaiian monk seals. The NWHI lobster fishery was closed in 2000 due to uncertainty in the estimates of biomass, and the fishery remains closed to date. ~~Neither incidental mortality nor serious injury were observed by NMFS observers of the lobster fishery through 2001, though one mortality was documented in 1986. The potential for indirect interaction due to competition for prey is being investigated (see Habitat Issues below)~~

In the past, interactions between the Hawaii-based domestic pelagic longline fishery and monk seals were documented (NMFS 2002). This fishery targets swordfish and tunas~~, primarily,~~ and does not compete with Hawaiian monk seals for prey. In October 1991, in response to 13 unusual seal wounds thought to have resulted from interactions with this fishery, NMFS established a ~~permanent~~ Protected Species Zone extending 50 nautical miles around the NWHI and the corridors between the islands. Subsequently, no additional ~~shore-based observations of seals have found no further evidence of~~ monk seal interactions with the longline fishery have been confirmed. ~~Until 2000, interactions with protected species were assessed using Federal logbooks and observers (4-5% coverage) Since 2001, the observer program has maintained observer over 20% coverage of levels for the Hawaii-based longline fleet. above 20%. However, s~~Since 1991, there have been no observed or reported interactions of this fishery with monk seals.

The NWHI bottomfish handline fishery has been reported to interact with monk seals. This fishery occurred at low levels (< 50 t per year) until 1977, steadily increased to 460 metric tons in 1987, then dropped to 284 metric tons in 1988, and varied from 95-201 metric tons per year from 1989-20022003 (Kawamoto 1995; Kawamoto , pers. comm.). The number of vessels peaked at ~~rose from 19 in 1984 to~~ 28 in 1987, ~~and~~ then varied from 9 to 17 in 1988 through 20022003 (Kawamoto 1995; Kawamoto , pers. comm.). ~~Currently, the bottomfish fishery remains open, although its area of operation has been substantially restricted by President Clinton's Executive Order (1/18/2001).~~ NMFS ~~has~~ prepared ~~an Environmental Impact Statement and prepared~~ a Section 7 Biological Opinion on the Fishery Management Plan for the bottomfish fishery, and concluded that the operation of this fishery is not likely to jeopardize the continued existence of the Hawaiian monk seal nor would it likely destroy or adversely modify the monk seal's critical habitat (NMFS 2002). The Biological Opinion has no incidental take statement, though a MMPA Negligible Impact Determination is currently being prepared. An EIS for the bottomfish fishery management plan is also being prepared. Nitta and Henderson (1993) ~~The authors~~ documented ~~observer~~

reports of seals taking bottomfish and bait off fishing lines, and reports of seals attracted to discarded ~~bottomfish~~ bycatch. A Federal observer program of the fishery began in the fourth quarter of 2003 with 33% coverage and no monk seal interactions during that quarter. Fishermen indicate that they have engaged in mitigating activity over the past several years, e.g., holding discards on-board, etc. (NMFS pers. comm..). ~~The fishery is currently monitored by the State of Hawaii using logbooks. However, the State logbook does not include information on protected species and, therefore, the nature and extent of interactions with monk seals cannot be assessed from logbooks. Fishers, however, are required to report all incidental mortality and injury within 48 hours of their return to port (pursuant to MMPA section 118(e)); no such mortality or injury has been reported since 1994 when the MMPA was amended to include section 118. Nitta and Henderson (1993) evaluated observer data from 1991-92 and reported an interaction rate of one event per 34.4 hours of fishing, but they do not provide a confidence interval for their estimate.~~ The ecological effects of this fishery on monk seals (e.g., competition for prey or alteration of prey assemblages ~~by removal of key predator fishes~~) are unknown. However, published studies on monk seal prey selection based upon scat/spew analysis and seal-mounted video, rarely revealed evidence that monk seals fed on families of bottomfish which contain commercial species (many prey items recovered from scats and spews were identified only to the level of family; Goodman-Lowe 1998, Parrish et al. 2000). Fatty acid signature analysis is incomplete regarding the importance of commercial bottomfish in the monk seal diet, but this methodology continues to be pursued.

There have also been interactions between nearshore fisheries and monk seals in both the NWHI and the MHI. At least three seals were hooked at Kure Atoll before the U.S. Coast Guard vacated the atoll in 1993. In the main Hawaiian Islands (MHI), one seal was found dead in a nearshore (non-recreational) gillnet in 1994 and a second seal was found dead in 1995 with a hook lodged in its esophagus. A total of 20 ~~16~~ seals have been observed with embedded hooks in the MHI during ~~1989-2002~~1990-2003. Several incidents, including the dead hooked seal mentioned above, involved hooks used to catch ulua (jacks, *Caranx* spp.). Interactions in the MHI appear to be on the rise, as most ~~half the observed~~ hookings have occurred since 2000, and a seal was ~~also~~ entangled in an actively fished nearshore gillnet off Oahu in 2002 (NMFS unpubl. data). The MHI bottomfish handline fishery also has potential to interact with monk seals, though no mortalities or serious injuries have been attributed to the fishery (Table 1).

Episodic interest in the harvest of precious coral in the NWHI represents a potential for future interactions with monk seals, as ~~However,~~ some seals forage at ~~patches of~~ precious gold coral beds occurring over 500m in depth (Parrish et al., 2002). As a result, the Western Pacific Regional Fisheries Management Council ~~has~~ recommended regulations to suspend or set to zero annual quotas for gold coral harvest at specific locations until data on impacts of such harvests become available.

Table 1. Summary of ~~incidental~~ mortality and serious injury of Hawaiian monk seals due to ~~commercial and recreational~~ fisheries ~~since 1990~~ and calculation of annual mortality rate. n/a indicates that sufficient data are not available.

~~Fishery Name~~	~~Years~~	~~Range of # of vessels per year~~	~~Data type~~	~~Range of observer coverage~~	~~Total observed mort.~~	~~Estimated mort. (in given years)~~	~~Mean annual mort.~~
~~NWHI lobster~~	~~1991-2000~~	~~0-1a2~~	~~Observer Log book~~	~~0-100%~~	~~0~~	~~n/a~~	~~n/a~~
~~NWHI Bottomfish~~	~~1991-2002~~	~~9-17~~			~~n/a~~	~~n/a~~	~~n/a~~
~~Pelagic longline~~	~~1991-2002~~	~~100-141~~	~~Observer Log book~~	~~3-28%~~	~~0~~	~~n/a~~	~~N/a~~
~~NearshoreRecreational~~	~~1991-1995~~	~~n/a~~	~~n/a~~	~~n/a~~	~~2[‡]~~	~~n/a~~	~~N/a~~

~~[‡] Data collected incidentally.~~

Fishery Name	Year	Data Type	% Obs. coverage	Observed Mortality/ Serious Injury	Estimated Mortality/ Serious Injury	Mean Takes (CV)
NWHI Lobster	1999 2000-present	data collector[1] fishery closed	83%	0	n/a	n/a
Pelagic Longline[2]	1999 2000 2001 2002 2003	observer observer observer observer observer	3.3% 10.4% 22.5% 24.6% 22.2%	0 0 0 0 0	0 0 0 0 0	0 (0)
NWHI Bottomfish	1999-2002 2003[3]	logbook observer	n/a 33%	n/a 0	n/a 0	0 (0)
MHI Bottomfish[4]	1999 2000 2001 2002 2003	n/a	none	0 0 0 0 0	n/a	n/a
Nearshore[4]	1999 2000 2001 2002 2003	n/a	none	0 1 1 1 2	n/a	n/a

Fishery Mortality Rate

Data are unavailable to fully assess interaction with ~~specific~~ some fisheries in Hawaii, ~~thus one cannot conclude that the total fishery mortality and serious injury for this stock is less than 10% of the calculated PBR. T~~ therefore, total fishery mortality and serious injury cannot be considered to be insignificant and approaching a rate of zero. Monk seals also ~~continue to~~ die from entanglement in ~~North Pacific~~ fishing gear and other debris (likely originating from various countries), and NMFS along with partner agencies, is pursuing a program to mitigate entanglement ~~this source of mortality~~ (see below).

Direct fishery interactions with monk seals remain~~s~~ to be thoroughly evaluated and the information above represents only observed interactions. Without further study, an accurate estimate cannot be determined. ~~In addition, interactions may be i~~Indirect interactions (i.e., involving competition for prey or consumption of discards ~~from the bottomfish fishery~~) ~~and, to date, the extent or consequences of such indirect interactions~~ remain the topic of ongoing investigation.

Entanglement in Marine Debris

Hawaiian monk seals become entangled in fishing and other marine debris at rates higher than reported for other pinnipeds (Henderson 2001). A total of 238~~222~~ cases of seals entangled in fishing gear or other debris have been observed through ~~2002~~2003 (Henderson 2001; NMFS, unpubl. data), including seven documented mortalities resulting from entanglement in fisheries debris (Henderson 1990, 2001; NMFS, unpubl. data). The fishing gear fouling the reefs and beaches of the NWHI and entangling monk seals only rarely includes types used in Hawaiian fisheries. For example, trawl net and monofilament gillnet accounted for approximately 35% and 34% of the debris removed from reefs in the NWHI by weight, and trawl net alone accounted for 88% of the debris by frequency (Donohue et al. 2001). Yet there are no commercial trawl fisheries in Hawaii.

The NMFS and partner agencies continue to ~~pursue an ambitious effort to~~ mitigate impacts of marine

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[1] Fishery participants voluntarily hosted technicians to collect biological data, including protected species interactions. Because this was not conducted as an official observer program, mortality and serious injury rates were not estimated.

[2] Until 2000, interactions with protected species were assessed using Federal logbooks and observers (4-5% coverage). Since 2001, the observer program has maintained over 20% coverage of the Hawaii-based longline fleet.

[3] Observer coverage began in fourth quarter of 2003. Data for that quarter provided.

[4] Data for MHI bottomfish and nearshore fishery are based upon incidental observations (i.e., hooked seals). Following the method employed in a draft Negligible Impact Determination for the bottomfish fishery, all hookings not clearly attributable to either fishery with certainty were attributed to the bottomfish fishery, and hookings, which resulted in injury of unknown severity were classified as serious.

debris on monk seals as well as turtles, coral reefs and other wildlife. Marine debris is removed from beaches and entangled seals during annual population assessment activities at the main reproductive sites. During 1996-~~2002~~2003 debris survey and removal efforts, over 470,000~~360,000~~ kg of derelict net and other debris were removed from the coral reef habitat in the NWHI (Donohue et al. 2000, Donohue et al. 2001; J. Asher, pers. comm).

Other Mortality

Since 1982, 23 seals died during rehabilitation efforts; additionally, two died in captivity, two died when captured for translocation, one was euthanized (an aggressive male known to cause mortality), three died during captive research and three died during field research (Baker and Johanos, 2002).

In 1986, a weaned pup died at East Island, French Frigate Shoals, after becoming entangled in wire left when the U.S. Coast Guard abandoned the island three decades earlier. In 1991, a seal died after becoming trapped behind an eroding seawall on Tern Island, French Frigate Shoals. The only documented case of illegal killing of an Hawaiian monk seal occurred when a resident of Kauai killed an adult female in 1989.

Other sources of mortality~~, which~~ that may impede recovery~~,~~ include single and multiple-male aggression (mobbing), shark predation, and disease/parasitism. Multiple-male aggression is thought to be related to an imbalance in adult sex ratios, with males outnumbering females. When several males attempt to mount and mate with an adult female or immature animal of either sex, injury or death of the attacked seal often results. ~~The resulting increase in female mortality appears to have been a major impediment to recovery~~ This has primarily been identified as a problem at Laysan and Lisianski Islands, though it ~~. Since 1982, at least 67 seals have died or disappeared after suffering multiple male aggression at Laysan Island. Multiple male aggression~~ has also been documented at other subpopulations~~French Frigate Shoals, Kure Atoll, and Necker Island~~. ~~Multiple male aggression is thought to be related to an imbalance in adult sex ratios, with males outnumbering females.~~ In 1994, 22 adult males were removed from Laysan Island, and only five~~three~~ seals are thought to have died from multiple-male aggression ~~mobbing~~ at this site since their removal (1995-~~2002~~2003).

~~In addition, a~~Attacks by single adult males have resulted in several monk seal mortalities. This was most notable at French Frigate Shoals in 1997, where at least 8 pups died as a result of adult male aggression. Many more pups were likely killed in the same way but the cause of their deaths could not be confirmed. Two males that killed pups in 1997 were translocated to Johnston Atoll, 870 km to the southwest. Subsequently, mounting injury to pups have decreased.

Shark-related injury and mortality incidents ~~may~~ appeared to have increased in the late 1980s and early 1990s at French Frigate Shoals, but such mortality was probably not the primary cause of the decline at this site (Ragen 1993). However, ~~indications are that~~ shark predation has accounted for a significant portion of pup mortality in recent years. At French Frigate Shoals in 1999, 17 pups were observed injured by large sharks, and at least 3 were confirmed to have died from shark predation (Johanos and Baker, 2001). ~~It is believed that~~ As many as 2~~5~~ pups of a total 92 born at French Frigate Shoals in 1999 were likely killed by sharks. After 1999, losses of pups to shark predation have been fewer, but this source of mortality remains a serious concern. Various mitigation efforts have been undertaken by NMFS in cooperation with the USFWS, which manages French Frigate Shoals as part of the Hawaiian Islands National Wildlife Refuge.

An Unusual Mortality Event (UME) contingency plan has recently been published for the monk seal (Yochem et al. 2004). While disease effects on monk seal demographic trends are uncertain, there is concern that diseases of livestock, feral animals, pets or humans could be transferred to naive monk seals in the main Hawaiian Islands and potentially spread to the core population in the NWHI. Recent diagnoses (R. Braun, pers. comm.) confirm that in 2003 and 2004, two deaths of free-ranging monk seals are attributable to diseases not previously found in the species: leptospirosis and toxoplasmosis. Leptospira bacteria are found in many of Hawaii's streams and estuaries and are associated with livestock and rodents. Cats, domestic and feral, are a common source of toxoplasma. ~~In 2001, a was declared following the deaths of four yearling monk seals in the course of nine days at Laysan Island. At least 11 deaths occurred in the NWHI, but many more are suspected due to unusually low survival of juveniles at most subpopulations. Health screening of both healthy and unhealthy seals was conducted, and necropsies were performed on six seals. no evidence of infectious disease or toxicosis was found which would link the mortalities. However, all the necropsied animals were emaciated. Notably, while fewer dead seals were observed in 2002, overall yearling survival rates (2001 cohort) were comparable to those observed during the Unusual Mortality Event~~.

STATUS OF STOCK

In 1976, the Hawaiian monk seal was designated depleted under the Marine Mammal Protection Act of 1972 and as endangered under the Endangered Species Act of 1973. The species is ~~assumed to be~~ well below its ~~optimum sustainable population (~~OSP~~)~~ and has not recovered from past declines. Therefore, the Hawaiian monk seal is characterized as a strategic stock.

Habitat Issues

Vessel groundings pose a continuing threat to monk seals and their habitat, through potential physical damage to reefs, oil spills, and release of debris into habitats. ~~Two relatively recent groundings include the *Paradise Queen II*, a lobster fishing vessel, at Kure Atoll in 1998, and the 77-ft longliner *Swordman I* at Pearl and Hermes Reef in 2000.~~

~~Available data indicate that t~~The substantial decline at French Frigate Shoals ~~was~~ is likely related to lack of available prey and subsequent emaciation and starvation. Two leading hypotheses to explain the lack of prey are 1) the local population reached its carrying capacity in the 1970s and 1980s, diminishing its own food supply, and 2) carrying capacity was simultaneously reduced by changes in oceanographic conditions and a subsequent decline in productivity (Polovina et al. 1994; Craig and Ragen 1999). Similarly, recently observed poor juvenile survival rates suggest that prey availability may be limiting recovery of other NWHI subpopulations.

Goodman-Lowe (1998) provided information on prey selection using hard parts in scats and spewings. Information on at-sea movement and diving is available for seals at all six main subpopulations in the NWHI using satellite telemetry (Stewart 2004*a,b*; Stewart and Yochem 2004 *a,b,c*). Preliminary studies to describe the foraging habitat of monk seals in the MHI were begun ~~are underway~~ in 2004.

~~Currently, human activities in the NWHI are limited and, consequently, human disturbance, which impacted monk seals in the past (Ragen 1999), is relatively rare.~~

Tern Island is the site of a U.S. Fish and Wildlife refuge station, and is one of two sites in the NWHI accessible by aircraft. ~~The island and the runway have played a key role in efforts to study the local monk seal population and to mitigate its severe and ongoing decline.~~ During World War II, the U.S. Navy enlarged the island to accommodate the runway, and a sheet-pile seawall was constructed to maintain the modified shape of the island. Degradation of the seawall ~~is~~ created~~ing~~ entrapment hazards for seals and other ~~wildlife and is threatening to erode the runway~~. Erosion of the sea wall ~~has~~ also raised concerns about the potential release of toxic wastes into the ocean. The USFWS ~~Fish and Wildlife Service~~ began construction on the Tern I. sea wall in 2004 to reduce entrapment hazards and protect the island shoreline.~~scheduled to begin a project to repair and stabilize the seawall and shoreline of Tern Island in 2004.~~ The USFWS considers this a high priority project to complete, and is pursuing funding to that end. A recent review suggests that significant loss of terrestrial habitat has occurred at French Frigate Shoals, where pupping and resting islets have shrunk or virtually disappeared (Antonelis et al. in press). This is a subject of considerable interest and is under further investigation.

There are indications that monk seal abundance is increasing in the main Hawaiian Islands (Baker and Johanos 2004~~3~~). Further, the excellent condition of pups weaned on these islands suggests that there may be ample prey resources available. If the monk seal population does expand in the MHI, it may bode well for the species' recovery and long-term persistence. In contrast, there are many challenges that may limit the potential for growth in this region. The human population in the MHI is approximately 1.2 million compared to less than 100 in the NWHI, so that the potential impact of disturbance in the MHI is great. ~~Potential for disease transfer from domesticated animals to naive monk seals in the main islands, which could, in turn, transmit disease to the core population in the NWHI is also a concern.~~ As noted above, the hooking of monk seals by fishermen in the MHI is another source of injury and mortality. Finally, vessel traffic in ~~around~~ the populated islands carries the potential for collision with seals and impacts from oil spills. Thus, issues surrounding ~~the presence of~~ monk seals in the main Hawaiian Islands will likely become an increasing focus for management and recovery of this species.

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Revised ~~07/15/2004~~ 05/1/2005

KILLER WHALE (*Orcinus orca*): Eastern North Pacific Southern Resident Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Killer whales have been observed in all oceans and seas of the world (Leatherwood and Dahlheim 1978). Although reported from tropical and offshore waters, killer whales prefer the colder waters of both hemispheres, with greatest abundances found within 800 km of major continents (Mitchell 1975). Along the west coast of North America, killer whales occur along the entire Alaskan coast (Braham and Dahlheim 1982), in British Columbia and Washington inland waterways (Bigg et al. 1990), and along the outer coasts of Washington, Oregon, and California (Green et al. 1992; Barlow 1995, 1997; Forney et al. 1995). Seasonal and year-round occurrence has been noted for killer whales throughout Alaska (Braham and Dahlheim 1982) and in the intracoastal waterways of British Columbia and Washington State, where pods have been labeled as 'resident,' 'transient,' and 'offshore' (Bigg et al. 1990, Ford et al. 1994) based on aspects of morphology, ecology, genetics, and behavior (Ford and Fisher 1982, Baird and Stacey 1988, Baird et al. 1992, Hoelzel et al. 1998). Through examination of photographs of recognizable individuals and pods, movements of whales between geographical areas have been documented. For example, whales identified in Prince William Sound have been observed near Kodiak Island (Matkin et al. 1999) and whales identified in Southeast Alaska have been observed in Prince William Sound, British Columbia, and Puget Sound (Leatherwood et al. 1990, Dahlheim et al. 1997).

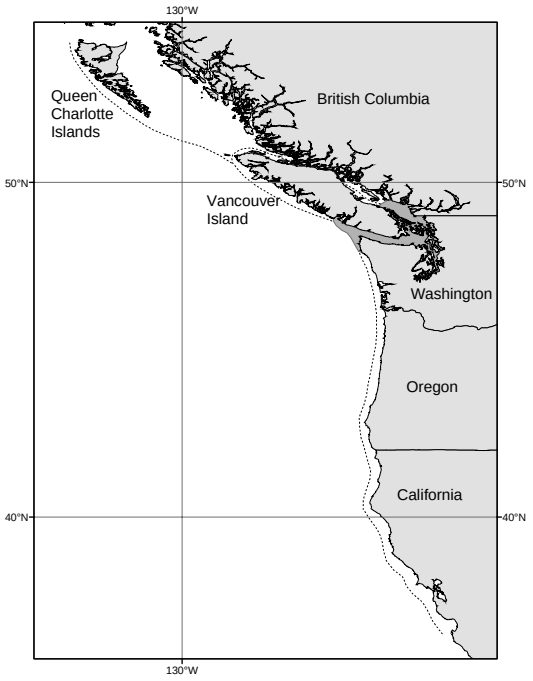

Figure 1. Approximate April-October distribution of the Eastern North Pacific Southern Resident killer whale stock (shaded area) and range of sightings (dotted line).

Studies on mtDNA restriction patterns provide evidence that the 'resident' and 'transient' types are genetically distinct (Stevens et al. 1989, Hoelzel 1991, Hoelzel and Dover 1991, Hoelzel et al. 1998). Analysis of 73 samples collected from eastern North Pacific killer whales from California to Alaska has demonstrated significant genetic differences among 'transient' whales from California through Alaska, 'resident' whales from the inland waters of Washington, and 'resident' whales ranging from British Columbia to the Aleutian Islands and Bering Sea (Hoelzel et al. 1998). However, low genetic diversity throughout this specie's world-wide distribution has hampered efforts to clarify its taxonomy. At an international symposium in cetacean systematics in May 2004, a workshop was held to review the taxonomy of killer whales. A majority of invited experts felt that the Resident- and Transient-type whales in the eastern North Pacific probably merited species or subspecies status (Reeves et al. 2004).

Most sightings of the Eastern North Pacific Southern Resident stock of killer whales have occurred in the summer in inland waters of Washington and southern British Columbia. However, pods belonging to this stock have also been sighted in coastal waters off southern Vancouver Island and Washington (Bigg et al. 1990, Ford et al. 2000). The complete winter range of this stock is uncertain. Of the three pods comprising this stock, one (J1) is commonly sighted in inshore waters in winter, while the other two (K1 and L1) apparently spend more time offshore (Ford et al. 2000). Pods K1 and L1 are often seen entering the inland waters of Vancouver Island from the north–through Johnstone Strait–in the spring (Ford et al. 2000), suggesting that they may spend time along the entire outer coast of Vancouver Island during the winter. In May 2003, these pods were sighted off the northern end of the Queen Charlotte Islands, the furthest north they had ever previously been documented (J. Ford, pers. comm.). Off the Washington coast, Southern Resident killer whales have been sighted as far south as Grays Harbor (season unknown) (Bigg et al. 1990), and members of pods K1 and L1 were observed in Monterey Bay, California, in January 2000 and March 2003 (N. Black, pers. comm.).

Based on data regarding association patterns, acoustics, movements, genetic differences and potential fishery interactions, five killer whale stocks are recognized within the Pacific U.S. EEZ: 1) the Eastern North Pacific Northern Resident stock - occurring from British Columbia through Alaska, 2) the Eastern North Pacific Southern Resident stock - occurring mainly within the inland waters of Washington State and southern British Columbia (see Fig. 1), 3) the Eastern North Pacific Transient stock - occurring from Alaska through California, 4) the Eastern North Pacific Offshore stock - occurring from Southeast Alaska through California, and 5) the Hawaiian stock. The Stock Assessment Reports for the Alaska Region contain information concerning the Eastern North Pacific Northern Resident and Eastern North Pacific Transient stocks.

POPULATION SIZE

The Eastern North Pacific Southern Resident stock is a trans-boundary stock including killer whales in inland Washington and southern British Columbia waters. Photo-identification of individual whales through the years has resulted in a substantial understanding of this stock's structure, behaviors, and movements. In 1993, the three pods comprising this stock totaled 96 killer whales (Ford et al. 1994). The population increased to 99 whales in 1995, then declined to 79 whales in 2001 before increasing slightly to ~~83~~84 whales in ~~2003~~2004 (Fig. 2; Ford et al. 2000; Center for Whale Research, unpubl. data). The 2001-2004~~, 2002, and 2003~~ counts include a whale born in 1999 (L-98) that was listed as missing during the annual census in May and June 2001 but was subsequently discovered alone in an inlet off the west coast of Vancouver Island (J. Ford, pers. comm.). As of October ~~2003~~2004, L-98 has remained separate from L pod and it remains unclear whether it will rejoin L pod in the future, either on its own or through a proposed reintroduction effort. For now, it will be included in the current population size. However, ~~one~~ two new ~~calf~~ calves observed in the fall of ~~2003~~ 2004 will not be a part of the official census until seen in May/June ~~2004~~ 2005 (Center for Whale Research, unpubl. data).

Minimum Population Estimate

The abundance estimate for this stock of killer whales is a direct count of individually identifiable animals. It is thought that the entire population is censused every year. This estimate therefore serves as both a best estimate of abundance and a minimum estimate of abundance. Thus, the minimum population estimate (N_{MIN}) for the Eastern North Pacific Southern Resident stock of killer whales is ~~83~~ 84 animals.

Current Population Trend

During the live-capture fishery that existed from 1967 to 1973, it is estimated that 47 killer whales, mostly immature, were taken out of this stock (Ford et al. 1994). The first complete census of this stock occurred in 1974. Between 1974 and 1993 the Southern Resident stock increased approximately 35%, from 71 to 96 individuals (Ford et al. 1994). This represents a net annual growth rate of 1.8% during those years. Since 1995, the population declined to 79 whales before increasing ~~in~~ from 2002-2004 ~~and 2003~~ to a total of ~~83~~ 84 whales (Ford et al. 2000; Center for Whale Research, unpubl. data).

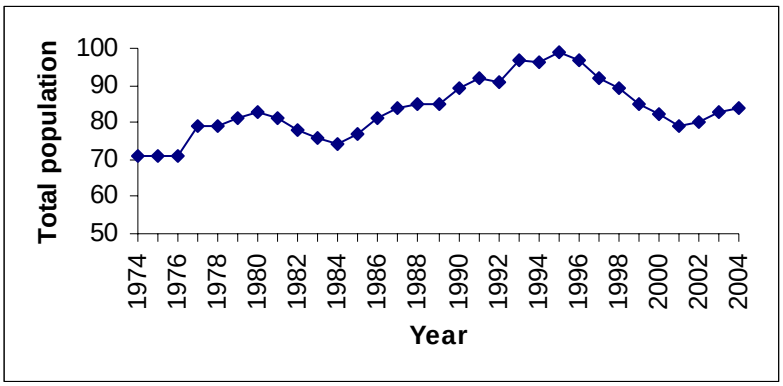

Figure 2. Population of Eastern North Pacific Southern Resident stock of killer whales, ~~1974-2003~~ 1974-2004. Each year's count includes animals first seen and first missed; a whale is considered first missed the year after it was last seen alive (Ford et al. 2000; Center for Whale Research, unpubl. data).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently unavailable for this stock of killer whales. Studies of 'resident' killer whale pods in British Columbia and Washington waters resulted in estimated population growth rates of 2.92% and 2.54% over the period from 1973 to 1987 (Olesiuk et al. 1990, Brault and Caswell 1993). For southern resident killer whales, estimates of the population growth rate have been made during the three periods when the population has been documented increasing since monitoring began in 1974. From 1974 to 1980 the population increased at a rate of 2.6%/year, 2.3%/year from 1985 to 1996, and 2.5%/year from 2002 to 2003 (Krahn et al. 2004). However, a population increases at the maximum growth rate (R_{MAX}) only when the

population is at extremely low levels; thus, any of these ~~the~~ estimates ~~of 2.92%~~ may be an underestimate of R_{MAX}. Hence, until additional data become available, it is recommended that the cetacean maximum theoretical net productivity rate (R_{MAX}) of 4% be employed for this stock (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for this stock is calculated as the minimum population size (~~83~~84) times one-half the default maximum net growth rate for cetaceans (½ of 4%) times a recovery factor of 0.5 (for a depleted stock, Wade and Angliss 1997), resulting in a PBR of 0.8 whales per year.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

NMFS observers have monitored the northern Washington marine set gillnet fishery since 1988 (Gearin et al. 1994, 2000; P. Gearin, unpubl. data). Observer coverage ranged from approximately 40 to 83% in the entire fishery (coastal + inland waters) between 1998 and 2002. There was no observer coverage in this fishery ~~in~~ from 1999~~, 2001, or 2002~~-2003. However, the total fishing effort was 4, 46, ~~and~~ 4.5 and 7 net days (respectively) in those years, it occurred only in inland waters, and no killer whale takes were reported. No killer whale mortalities have been recorded in this fishery since the inception of the observer program.

In 1993, as a pilot for future observer programs, NMFS in conjunction with the Washington Department of Fish and Wildlife (WDFW) monitored all non-treaty components of the Washington Puget Sound Region salmon gillnet fishery (Pierce et al. 1994). Observer coverage was 1.3% overall, ranging from 0.9% to 7.3% for the various components of the fishery. Encounters (whales within 10 m of a net) with killer whales were reported, but not quantified, though no entanglements occurred.

In 1994, NMFS and WDFW conducted an observer program during the Puget Sound non-treaty chum salmon gillnet fishery (areas 10/11 and 12/12B). A total of 230 sets were observed during 54 boat trips, representing approximately 11% observer coverage of the 500 fishing boat trips comprising the total effort in this fishery, as estimated from fish ticket landings (Erstad et al. 1996). No interactions with killer whales were observed during this fishery. The Puget Sound treaty chum salmon gillnet fishery in Hood Canal (areas 12, 12B, and 12C) and the Puget Sound treaty sockeye/chum gillnet fishery in the Strait of Juan de Fuca (areas 4B, 5, and 6C) were also monitored in 1994 at 2.2% (based on % of total catch observed) and approximately 7.5% (based on % of observed trips to total landings) observer coverage, respectively (NWIFC 1995). No interactions resulting in killer whale mortalities were reported in either treaty salmon gillnet fishery.

Also in 1994, NMFS, WDFW, and the Tribes conducted an observer program to examine seabird and marine mammal interactions with the Puget Sound treaty and non-treaty sockeye salmon gillnet fishery (areas 7 and 7A). During this fishery, observers monitored 2,205 sets, representing approximately 7% of the estimated number of sets in the fishery (Pierce et al. 1996). Killer whales were observed within 10 m of the gear during 10 observed sets (32 animals in all), though none were observed to have been entangled.

Killer whale takes in the Washington Puget Sound Region salmon drift gillnet fishery are unlikely to have increased since the fishery was last observed in 1994, due to reductions in the number of participating vessels and available fishing time (see details in Appendix 1). Fishing effort and catch have declined throughout all salmon fisheries in the region due to management efforts to recover ESA-listed salmonids.

An additional source of information on the number of killer whales killed or injured incidental to commercial fishery operations is the self-reported fisheries information required of vessel operators by the MMPA. During the period between 1994 and ~~2002~~2003 , there were no fisher self-reports of killer whale mortalities from any fisheries operating within the range of this stock. However, because logbook records (fisher self-reports required during 1990-94) are most likely negatively biased (Credle et al. 1994), these are considered to be minimum estimates. Logbook data are available for part of 1989-1994, after which incidental mortality reporting requirements were modified. Under the new system, logbooks are no longer required; instead, fishers provide self-reports. Data for the 1994-1995 phase-in period is fragmentary. After 1995, the level of reporting dropped dramatically, such that the records are considered incomplete and estimates of mortality based on them represent minimums (see Appendix 7 in Angliss and Lodge 2002 for details).

Due to a lack of observer programs, there are few data concerning the mortality of marine mammals incidental to Canadian commercial fisheries. Since 1990, there have been no reported fishery-related strandings of killer whales in Canadian waters. However, in 1994 one killer whale was reported to have contacted a salmon gillnet but did not entangle (Guenther et al. 1995). Data regarding the level of killer whale mortality related to commercial fisheries in Canadian waters are not available, though the mortality level is thought to be minimal.

During this decade there have been no reported takes from this stock incidental to commercial fishing operations (D. Ellifrit, pers. comm.), no reports of interactions between killer whales and longline operations (as occurs in Alaskan waters; see Yano and Dahlheim 1995), no reports of stranded animals with net marks, and no photographs of individual whales carrying fishing gear. The total fishery mortality and serious injury for this stock is zero.

Other Mortality

According to Northwest Marine Mammal Stranding Network records, maintained by the NMFS Northwest Region, no human-caused killer whale mortalities or serious injuries were reported from non-fisheries sources in 1998-~~2002~~2003.

STATUS OF STOCK

NMFS received a petition from the Center for Biological Diversity and 10 co-petitioners on 2 May 2001 (an 11th co-petitioner was added on 16 July 2001) to list the Eastern North Pacific Southern Resident stock of killer whales as an "endangered" or "threatened" species under the Endangered Species Act (ESA) and to designate critical habitat for this stock under that Act. NMFS determined that the petition presented substantial scientific information indicating that a listing may be warranted thus was required to conduct an ESA status review of the stock (66 FR 42499, 13 August 2001). NMFS established a Biological Review Team (BRT) for this purpose and, in accordance with the BRT report (Krahn et al. 2002), determined that Southern Resident killer whales are not a "species" under the ESA and that a listing of "threatened" or "endangered" was not warranted (67 FR 44133, 1 July 2002). The BRT report (Krahn et al. 2002) identified potential risk factors that could influence this killer whale population, including: changes in prey availability, caused by fluctuations in environmental conditions (e.g., El Niño events); high levels of contaminants (Ross et al. 2000, Ylitalo et al. 2001); noise generated by whale-watching vessels; diseases and parasites; declines in stocks of salmon which are important prey; and catastrophes, such as oil spills and blooms of harmful algae. However, few quantitative data are available to determine which, if any, of these factors are likely to place the population in imminent danger of extinction. NMFS will continue to seek new information on the taxonomy, biology, and ecology of these whales, as well as potential threats to their continued existence, and will reassess their status under the ESA within 4 years (67 FR 44133, 1 July 2002). NMFS reviewed the status of the stock under the MMPA, determined that the stock is below its Optimum Sustainable Population (OSP), classified the stock as "depleted" under the MMPA, and announced its intention to prepare a Conservation Plan to reverse the decline and to promote recovery of the stock to OSP (68 FR 31980, 29 May 2003). In December 2003, the U.S. District Court set aside NMFS's not warranted finding relative to the 2001 ESA petition. Because the finding concluded that NMFS had erred by using "inaccurate" global species of Orcinus orca when considering whether southern residents were a distinct population segment (DPS), NMFS reconvened the southern resident killer whale Biological Review Team to review taxonomy and other new information that had become available since its 2002 Status Review. The BRT concluded that based on the new information southern resident killer whales were a DPS of the North Pacific resident taxon (Krahn et al. 2004). On December 16, 2004 NMFS announced its proposal to list southern resident killer whales as threatened under the ESA (69 FR 76673, 22 December 2004).

Based on currently available data, the total fishery mortality and serious injury for this stock (0) is not known to exceed 10% of the calculated PBR (0.08) and, therefore, appears to be insignificant and approaching zero mortality and serious injury rate. The estimated annual level of human-caused mortality and serious injury of zero animals per year is not known to exceed the PBR (0.8). However, because the Eastern North Pacific Southern Resident killer whale stock has been designated as "depleted" under the MMPA, it is classified as a "strategic" stock.

In April 1999, Canada's Committee on the Status of Endangered Wildlife in Canada (COSEWIC) listed resident killer whales in British Columbia as "threatened," i.e., likely to become "endangered" if limiting factors are not reversed (Baird 1999). In November 2001, COSEWIC split the original listing for resident killer whales into two populations. The northern resident population was designated as "threatened" and the southern resident population was designated as "endangered," i.e., facing imminent extirpation or extinction (COSEWIC 2003). In June 2000, the Washington Department of Fish and Wildlife (WDFW) designated killer whales in Washington State as a "state candidate species" (a species that the Department will review for possible listing as "state endangered, threatened, or sensitive"). In October 2003, WDFW released a draft status review which proposes that Southern Resident killer whales be added to the state's endangered species list (WDFW 2003). In April 2004, the Washington State Fish and Wildlife Commission approved the addition of killer whales to the State's endangered species list.

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SHORT-FINNED PILOT WHALE (*Globicephala macrorhynchus*): California/Oregon/Washington Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Short-finned pilot whales were once commonly seen off Southern California, with an apparently resident population around Santa Catalina Island, as well as seasonal migrants (Dohl et al. 1980). After a strong El Niño event in 1982-83, short-finned pilot whales virtually disappeared from this region, and despite increased survey effort along the entire U.S. west coast, few sightings were made from 1984-1992 (Jones and Szczepaniak 1992; Barlow 1997; Carretta and Forney 1993; Shane 1994; Green et al. 1992, 1993). In 1993, six groups of short-finned pilot whales were again seen off California (Carretta et al. 1995; Barlow and Gerrodette 1996), and mortality in drift gillnets increased (Julian and Beeson 1998) but sightings remain rare (Barlow 1997). Figure 1 summarizes the sighting history of short-finned pilot whales off the U.S. west coast. Although the full geographic range of the California/Oregon/Washington population is not known, it may be continuous with animals found off Baja California, and its individuals are morphologically distinct from short-finned pilot whales found farther south in the eastern tropical Pacific (Polisini 1981). Separate southern and northern forms of short-finned pilot whales have also been documented for the western North Pacific (Kasuya et al. 1988; Wada 1988; Miyazaki and Amano 1994). For the Marine Mammal Protection Act (MMPA) stock assessment reports, short-finned pilot whales within the Pacific U.S. Exclusive Economic Zone are divided into two discrete, non-contiguous areas: 1) waters off California, Oregon and Washington (this report), and 2) Hawaiian waters.

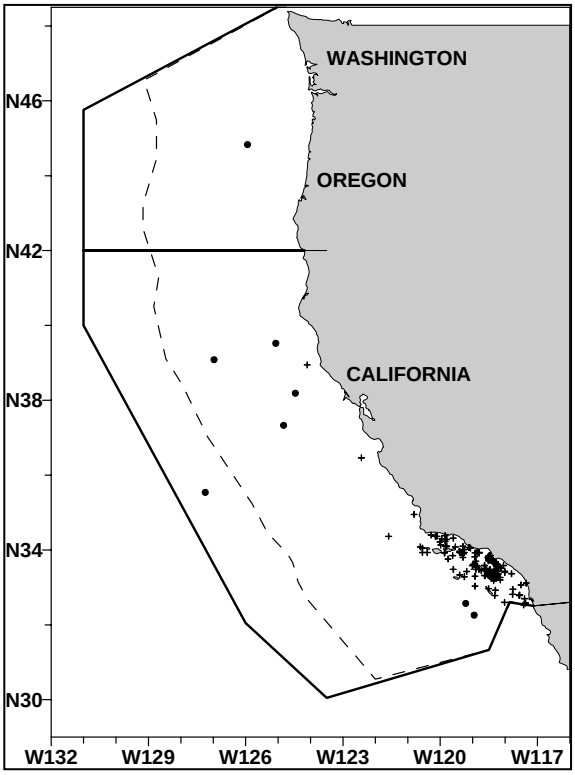

Figure 1. Short-finned pilot whale sightings made during aerial and shipboard surveys conducted off California in 1975-83 (+) and off California, Oregon, and Washington, 1991- 2001 (!). See Appendix 2 for data sources and information on timing and location of survey effort. Dashed line represents the U.S. EEZ, thick line indicates the outer boundary of all surveys combined.

POPULATION SIZE

Only two groups of pilot whales (numbering approximately 80 animals) were seen during the two most recent ship surveys conducted off California, Oregon, and Washington in 1996 and 2001 (Barlow 1997; Barlow 2003). All animals were seen during the 1996 survey. The abundance of short-finned pilot whales in this region appears to be variable and may relate to oceanographic conditions, as with other odontocete species (Forney 1997, Forney and Barlow 1998). Because animals may spend time outside the U.S. Exclusive Economic Zone as oceanographic conditions change, a multi-year average abundance estimate is the most appropriate for management within U.S. waters. The 1996-2001 weighted average abundance estimate for California, Oregon and Washington waters based on the two ship surveys is 304 (CV= 1.02) short-finned pilot whales (Barlow 2003).

Minimum Population Estimate

The log-normal 20th percentile of the 1996-2001 weighted average abundance estimate is 149 short-finned pilot whales.

Current Population Trend

Approximately nine years after the virtual disappearance of short-finned pilot whales following the 1982-83 El Niño, they appear to have returned to California waters, as indicated by an increase in sighting records as well as incidental fishery mortality (Barlow and Gerrodette 1996; Carretta et al. 1995; Julian and Beeson 1998). However, this cannot be considered a true growth in the population, because it merely reflects large-scale, long-term movements of this species in response to changing oceanographic conditions. It is not known where the animals went after the 82-83 El Niño, nor where the recently observed animals came from. Until the range of this population and the movements of animals in relation to environmental conditions are better documented, no inferences can be drawn regarding trends in abundance of short-finned pilot whales off California, Oregon and Washington.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

No information on current or maximum net productivity rates is available for short-finned pilot whales off California, Oregon and Washington.

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for this stock is calculated as the minimum population size (149) times one half the default maximum net growth rate for cetaceans (½ of 4%) times a recovery factor of 0.40 (for a species of unknown status with a mortality rate CV>0.80; Wade and Angliss 1997), resulting in a PBR of ~~1.19~~ 1.2 short-finned pilot whales per year.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fishery Information

A summary of known fishery mortality and injury for this stock of short-finned pilot whale is shown in Table 1. More detailed information on these fisheries is provided in Appendix 1. Mortality estimates for the California drift gillnet fishery are included for the five most recent years of monitoring, ~~1997-2001~~ 1999-2003 (Cameron and Forney 1999, 2000; Carretta 2001, 2002; Carretta and Chivers 2003, 2004). After the 1997 implementation of a Take Reduction Plan, which included skipper education workshops and required the use of pingers and minimum 6-fathom extenders, overall cetacean entanglement rates in the drift gillnet fishery dropped considerably (Barlow and Cameron 2003). However, because of interannual variability in entanglement rates and the relative rarity of short-finned pilot whale entanglements, additional years of data will be required to fully evaluate the effectiveness of pingers for reducing mortality of this particular species. ~~The observed mortality of a single short-finned pilot whale in 1997 was in a pingered net.~~ There have been 11 pilot whale mortalities observed in this fishery since 1990. In 1993, there were 8 mortalities observed, and one each in 1990, 1992, 1997 (in an unpingered net) and 2003. Mean annual takes in Table 1 are based on ~~1997-2001~~ 1999-2003 data. This results in an average estimate of ~~1.2~~ 1.0 (CV=~~0.96~~1.00) short-finned pilot whales taken annually.

Drift gillnet fisheries for swordfish and sharks exist along the entire Pacific coast of Baja California, Mexico and may take animals from this population. Quantitative data are available only for the Mexican swordfish drift gillnet fishery, which uses vessels, gear, and operational procedures similar to those in the U.S. drift gillnet fishery, although nets may be up to 4.5 km long (Holts and Sosa-Nishizaki 1998). The fleet increased from two vessels in 1986 to 31 vessels in 1993 (Holts and Sosa-Nishizaki 1998). The total number of sets in this fishery in 1992 can be estimated from data provided by these authors to be approximately 2700, with an observed rate of marine mammal bycatch of 0.13 animals per set (10 marine mammals in 77 observed sets; Sosa-Nishizaki et al. 1993). This overall mortality rate is similar to that observed in California driftnet fisheries during 1990-95 (0.14 marine mammals per set; Julian and Beeson, 1998), but species-specific information is not available for the Mexican fisheries. Previous efforts to convert the Mexican swordfish driftnet fishery to a longline fishery have resulted in a mixed-fishery, with 20 vessels alternately using longlines or driftnets, 23 using driftnets only, 22 using longlines only, and seven with unknown gear type (Berdegué 2002).

Historically, short-finned pilot whales were also killed in squid purse seine operations off Southern California (Miller et al. 1983; Heyning et al. 1994). No recent mortality has been reported, presumably because short-finned pilot whales are no longer common in the areas of squid purse seine fishing activity; however, there have been recent anecdotal reports of pilot whales seen near squid fishing operations off Southern California during the October 1997- April 98 fishing season. This fishery is not currently monitored, and has expanded markedly since 1992 (Vojkovich 1998).

Table 1. Summary of available information on the incidental mortality and injury of short-finned pilot whales (California/ Oregon/Washington Stock) in commercial fisheries that might take this species. All observed entanglements of pilot whales resulted in the death of the animal. Coefficients of variation for mortality estimates are provided in parentheses; n/a = not available. Mean annual takes are based on ~~1997-2001~~ 1999-2003 data unless noted otherwise.

Fishery Name	Data Type	Year(s)	Percent Observer Coverage	Observed Mortality	Estimated Annual Mortality	Mean Annual Takes (CV in parentheses)
CA/OR thresher shark/swordfish drift gillnet fishery	observer data	~~1997~~ ~~1998~~ 1999 2000 2001 2002 2003	~~22.8 %~~ ~~20.2 %~~ 20.0% 22.9% 20.4% 22.0% 20.0%	~~1~~ ~~0~~ 0 0 0 0 1	~~6 (0.96)~~ ~~0~~ 0 0 0 0 5 (1.00)	~~1.2 (0.96)~~ 1.0 (1.00)
Undetermined (probably squid purse seine fishery)	strandings	1975-90	14 short-finned pilot whales stranded in Southern California with evidence of fishery interactions, probably with the squid purse seine fishery			n/a
Minimum total annual takes						~~1.2 (0.96)~~ 1.0 (1.00)

STATUS OF STOCK

The status of short-finned pilot whales off California, Oregon and Washington in relation to OSP is unknown. They have declined in abundance in the Southern California Bight, likely a result of a change in their distribution since the 1982-83 El Niño, but the nature of these changes and potential habitat issues are not adequately understood. Short-finned pilot whales are not listed as "threatened" or "endangered" under the Endangered Species Act nor as "depleted" under the MMPA. The average annual human-caused mortality from ~~1997-2001~~ 1999-2003 is ~~1.2~~ 1.0 animals., which is ~~greater~~ less than the PBR (~~1.19~~ 1.2), and therefore they are not classified as a "strategic" stock under the MMPA.

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Revised ~~07/15/2004~~ 05/15/2005

HUMPBACK WHALE (*Megaptera novaeangliae*): Eastern North Pacific Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Although the International Whaling Commission (IWC) only considered one stock (Donovan 1991), there is now good evidence for multiple populations of humpback whales in the North Pacific (Johnson and Wolman 1984; Baker et al. 1990). Aerial, vessel, and photo-identification surveys, and genetic analyses indicate that within the U.S. EEZ, there are at least three relatively separate populations that migrate between their respective summer/fall feeding areas and winter/spring calving and mating areas (Calambokidis et al. 2001, Baker et al. 1998): 1) winter/spring populations in coastal Central America and Mexico which migrate to the coast of California to southern British Columbia in summer/fall (Steiger et al. 1991, Calambokidis et al. 1996) - referred to as the eastern North Pacific stock (Figure 1); 2) winter/spring populations of the Hawaiian Islands which migrate to northern British Columbia/Southeast Alaska and Prince William Sound west to Kodiak (Baker et al. 1990, Perry et al. 1990, Calambokidis et al. 2001) - referred to as the central North Pacific stock; and 3) winter/spring populations of Japan which, based on Discovery Tag information, probably migrate to waters west of the Kodiak Archipelago (the Bering Sea and Aleutian Islands) in summer/fall (Berzin and Rovnin 1966, Nishiwaki 1966, Darling 1991) - referred to as the western North Pacific stock. Winter/spring populations of humpback whales also occur in Mexico's offshore islands; the migratory destination of these whales is not well known (Calambokidis et al. 2001), but Norris et al. (1999) speculate that they may travel to the Bering Sea or Aleutian Islands. This stock structure represents the predominant migration patterns, but there is not a perfect correspondence between the breeding and feeding areas that are paired above. For example, some individuals migrate from Mexico to the Gulf of Alaska and others migrate from Japan to British Columbia. In general, interchange occurs (at low levels) between breeding areas, but fidelity is extremely high among the feeding areas (Calambokidis et al. 2001).

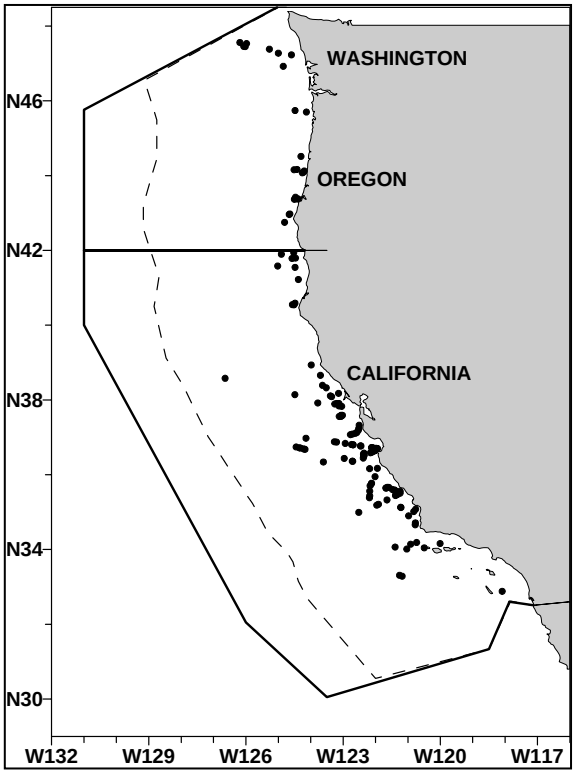

Figure 1. Humpback whale sightings based on shipboard surveys off California, Oregon, and Washington, 1991-2001. Dashed line represents the U.S. EEZ, thick line indicates the outer boundary of all surveys combined. See Appendix 2 for data sources and information on timing and location of survey effort.

Significant levels of genetic differences were found between the California and Alaska feeding groups based on analyses of mitochondrial DNA (Baker et al. 1990) and nuclear DNA (Baker et al. 1993). The genetic exchange rate between California and Alaska is estimated to be less than 1 female per generation (Baker 1992). Two breeding areas (Hawaii and coastal Mexico) showed fewer genetic differences than did the two feeding areas (Baker 1992). This is substantiated by the observed movement of individually identified whales between Hawaii and Mexico (Baker et al. 1990). There have been no individual matches between 597 humpbacks photographed in California and 617 humpbacks photographed in Alaska (Calambokidis et al. 1996). Only two of the 81 whales photographed in British Columbia have matched with a California catalog (Calambokidis et al. 1996), indicating that the U.S./Canada border is an approximate geographic boundary between feeding populations.

Until further information becomes available, three management units of humpback whales (as described above) are recognized within the U.S. EEZ of the North Pacific: the eastern North Pacific stock (this report), the central North Pacific stock, and the western North Pacific stock. The central and western North Pacific stocks are reported separately in the Stock Assessment Reports for the Alaska Region.

POPULATION SIZE

Based on whaling statistics, the pre-1905 population of humpback whales in the North Pacific was estimated to be 15,000 (Rice 1978), but this population was reduced by whaling to approximately 1,200 by 1966 (Johnson and Wolman 1984). The North Pacific total now almost certainly exceeds 6,000 humpback whales (Calambokidis et al. 1997). Estimates of the abundance of the eastern Pacific stock of humpback whales were made by aerial survey (Dohl 1983; Forney et al. 1995) and ship surveys (Barlow 1995), but those estimates are now over 9 years old and the aerial estimates did not include correction factors for diving whales that would be missed. More recent estimates are available from ship surveys and mark-recapture studies. Barlow (2003) estimated 1,314 (CV=0.30) humpbacks in California, Oregon, and Washington waters based on summer/fall ship line-transect surveys in 1996 and 2001. Calambokidis et al. (~~2003~~ 2004) estimated humpback whale abundance in these feeding areas from 1991 to ~~2002~~2003 using Petersen mark-recapture estimates based on photo-identification collections in adjacent pairs of years (Figure 2). These data show a general upward trend in abundance followed by a large (but not statistically significant) drop in the 1999/2000 and 2000/2001 estimates. The ~~2001/2002~~ 2002/2003 population estimate ~~(1,034, CV=0.11)~~ (1,391, CV=0.22) is higher than any previous estimates and may indicate that the apparent decline in the previous two estimates exaggerates any real decline that might have occurred (Calambokidis et al. 2003) or that a real decline was followed by an influx of new whales from another area (Calambokidis et al. 2004). This latter view is substantiated by the greater fraction of new whales seen for the first time in 2003 (Calambokidis et al. 2004). In general, mark-recapture estimates are negatively biased due to heterogeneity in sighting probabilities (Hammond 1986); however, this bias is likely to be minimal because the above mark-recapture estimate is based on data from ~~over~~ nearly half of the entire population (the ~~2001/2002~~ 2002/2003 data contained ~~506~~ 542 known individuals). The recent ship line transect estimate from 1996-2001 surveys is less precise than the mark-recapture estimates and is negatively biased because it does not include some humpback whales which could not be identified in the field and which were recorded as "unidentified large whale".

Minimum Population Estimate

The minimum population estimate for humpback whales in the California/Mexico stock is taken as the lower 20th percentile of the log-normal distribution of ~~2001/2002~~ 2002/2003 abundance estimated from mark-recapture methods (Calambokidis et al. ~~2003~~2004) or approximately ~~943~~1,158.

Current Population Trend

Ship surveys provide some indication that humpback whales increased in abundance in California coastal waters between 1979/80 and 1991 (Barlow 1994) and between 1991 and 1996 (Barlow 1997); however estimates declined between 1996 and 2001 (Barlow 2003). Mark-recapture population estimates increased steadily from 1988/90 to 1997-98 at about 8% per year (Calambokidis et al. 1999). The apparent dip in the 1999/2000 and 2000/2001 estimates may indicate that population growth is slowing, but ~~additional data are required to evaluate the significance of this~~ the subsequent increases in 2001/2002 and 2002/2003 casts some doubt on this explanation. Population estimates for the entire North Pacific have also increased substantially from 1,200 in 1966 to 6,000-8,000 circa 1992. Although these estimates are based on different methods and the earlier estimate is extremely uncertain, the growth rate implied by these estimates (6-7%) is consistent with the recently observed growth rate of the eastern North Pacific stock.

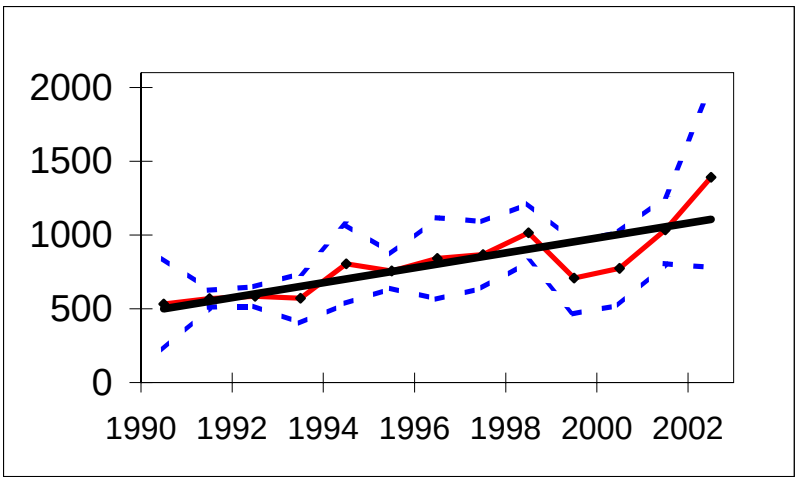

Figure 2. Mark-recapture estimates of the abundance of humpback whales feeding off California, Oregon, and Washington based on photo-identification studies (Calambokidis et al. ~~2003~~2004). Dotted lines indicate +/- 2 standard errors for each estimate. Straight, bold line indicates linear regression.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

The proportion of calves in

the California/Mexico stock from 1986 to 1994 appeared much lower than previously measured for humpback whales in other areas (Calambokidis and Steiger 1994), but in 1995-97 a greater proportion of calves were identified, and the 1997 reproductive rates for this population are closer to those reported for humpback whale populations in other regions (Calambokidis et al. 1998). Despite the apparently low proportion of calves, two independent lines of evidence indicate that this stock was growing in the 1980s and early 1990s (Barlow 1994; Calambokidis et al. 2003) with a best estimate of 8% growth per year (Calambokidis et al. 1999). The current net productivity rate is unknown.

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for this stock is calculated as the minimum population size (~~943~~ 1,158) times one half the estimated population growth rate for this stock of humpback whales (½ of 8%) times a recovery factor of 0.1 (for an endangered species with a total population size of less than 1,500), resulting in a PBR of ~~3.8~~4.6. Because this stock spends approximately half its time outside the U.S. EEZ, the PBR allocation for U.S. waters is ~~1.6~~2.3 whales per year.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Historic Whaling

The reported take of North Pacific humpback whales by commercial whalers totaled approximately 7,700 between 1947 and 1987 (C. Allison, IWC unpubl. data). In addition, approximately 7,300 were taken along the west coast of North America from 1919 to 1929 (Tonnessen and Johnsen 1982). Total 1910-1965 catches from the California-Washington stock includes at least the 2,000 taken in Oregon and Washington, the 3,400 taken in California, and the 2,800 taken in Baja California (Rice 1978). Shore-based whaling apparently depleted the humpback whale stock off California twice: once prior to 1925 (Clapham et al. 1997) and again between 1956 and 1965 (Rice 1974). There has been a prohibition on taking humpback whales since 1966.

Fishery Information

A ~~1998-2002~~ 1999-2003 summary of known fishery mortality and injury for this stock of humpback whales is given in Table 1. Detailed information on these fisheries is provided in Appendix 1. After the 1997 implementation of a Take Reduction Plan, which included skipper education workshops and required the use of pingers and minimum 6-fathom extenders, overall cetacean entanglement rates in the drift gillnet fishery dropped considerably (Barlow and Cameron 2003). Mean annual takes for this fishery (Table 1) are based on ~~1998-2002~~ 1999-2003 data. This results in an average estimate of zero humpback whales taken annually. Some gillnet mortality of large whales may go unobserved because whales swim away with a portion of the net. The deaths of two humpback whales that stranded in the Southern California Bight have been attributed to entanglement in fishing gear (Heyning and Lewis 1990), and a humpback whale was observed off Ventura, CA in 1993 with a 20 ft section of netting wrapped around and trailing behind. During the period ~~1998-2002~~ 1999-2003, a humpback cow-calf pair was seen entangled in a net off Big Sur, California (1999) and another lone humpback was seen entangled in line and fishing buoys off Grover City (2000), but the fate of these animals is not known (J. Cordero, NMFS unpubl. data). One humpback whale was entangled and released alive in the swordfish/thresher shark drift gillnet fishery in November of 1999 at N33°17' W120° 49' (set DN-SD-0949). Other unobserved fisheries may also result in injuries or deaths of humpback whales. ~~In 1997, one humpback whale was snagged by a central California salmon troller, and the animal swam away with the hook and many feet of trailing monofilament (NMFS, Southwest Region, unpublished data); this type of injury is not likely to be serious.~~ In 2001, a humpback whale with "pot gear" wrapped around its flukes was seen free-swimming 8 miles offshore of Point Bonita, California (NMFS, Southwest Region, unpublished data). In 2003, there were five separate reports of humpback whales entangled in crab pot and/or polypropylene lines (J. Cordero, NMFS, unpubl. data). In March 2003, an adult female with a calf was seen off Monterey with crab pot line wrapped around its flukes. An adult humpback was seen in May 2003 in the Santa Barbara Channel with 100 feet of yellow polypropylene line wrapped around it pectoral fins and caudal peduncle. Another adult female with a calf was seen in August 2003 west of the Farallon Islands with crab pot line with floats wrapped around its caudal peduncle and fluke lobe; the adult was reported to be 'diving awkwardly'. In November 2003, there were two reports within four days near Crescent City and south of Humboldt Bay of single humpback whales with crab pot line wrapped around their 'torso'. These two reports may represent the same whale. The final status of all these whales is unknown.

Drift gillnet fisheries for swordfish and sharks exist along the entire Pacific coast of Baja California, Mexico and may take animals from the same population. Quantitative data are available only for the Mexican

swordfish drift gillnet fishery, which uses vessels, gear, and operational procedures similar to those in the U.S. drift gillnet fishery, although nets may be up to 4.5 km long (Holts and Sosa-Nishizaki 1998). The fleet increased from two vessels in 1986 to 31 vessels in 1993 (Holts and Sosa-Nishizaki 1998). The total number of sets in this fishery in 1992 can be estimated from data provided by these authors to be approximately 2700, with an observed rate of marine mammal bycatch of 0.13 animals per set (10 marine mammals in 77 observed sets; Sosa-Nishizaki et al. 1993). This overall mortality rate is similar to that observed in California driftnet fisheries during 1990-95 (0.14 marine mammals per set; Julian and Beeson, 1998), but species-specific information is not available for the Mexican fisheries. Previous efforts to convert the Mexican swordfish driftnet fishery to a longline fishery have resulted in a mixed-fishery, with 20 vessels alternately using longlines or driftnets, 23 using driftnets only, 22 using longlines only, and seven with unknown gear type (Berdegué 2002).

Table 1. Summary of available information on the incidental mortality and injury of humpback whales (eastern North Pacific stock) for commercial fisheries that might take this species (Cameron and Forney ~~1999,~~ 2000; Carretta 2001, 2002; Carretta and Chivers 2003, 2004). Injury includes any entanglement that does not result in immediate death and may include serious injury resulting in death. n/a indicates that data are not available. Mean annual takes are based on ~~1998-2002~~ 1999-2003 data unless noted otherwise.

Fishery Name	Year(s)	Data Type	Percent Observer Coverage	Observed Mortality (and injury)	Estimated mortality (CV in parentheses)	Mean Annual Takes (CV in parentheses)
CA/OR thresher shark/swordfish drift gillnet fishery	~~1998~~ 1999 2000 2001 2002 2003	Observer data	~~20.0%~~ 20.0% 22.9% 20.4% 20.0% 20.3%	~~0~~ 0 0 0 0 0	Mortality 0,0,0,0,0 Injury 0,0,0,0,0	Mortality 0 Injury 0
CA angel shark/halibut and other species large mesh (>3.5") set gillnet fishery	1990-94 1999 2000 2001 2002 2003	Observer data	10-15% 23.1%[2] 26.9%[2] 0% 0% 0%	0,0,0,0,0 0[2] 0[2] 0[1] 0[1] 0[1]	0,0,0,0,0 0[2] 0[2] 0[1] 0[1] 0[1]	 0[1]
Unidentified fisheries	~~1998-2002~~ 1999-2003	Stranding& sightings	n/a	0 ~~(4)~~ (6)	n/a	>~~0.8~~ 1.2
~~**CA salmon troll fishery**~~	~~1997~~	~~Incidental report~~	~~0%~~	~~(1)~~	~~n/a~~	~~Injury >0.2 (n/a)~~
Total Annual Takes						>~~1.0~~ 1.2

[1] The CA set gillnets were not observed in 1995-98, and observations in 1999-2000 only included Monterey Bay; mortality for unobserved areas and times was extrapolated from effort estimates and 1991-94 entanglement rates. The fishery was not observed in 2001-2002, owing to area closures that reduced fishing effort to negligible levels.
[2] Observer coverage and observed mortality in 1999-2000 only includes the observed portion of the fishery in Monterey Bay. Observer coverage throughout the entire fishery was only 4.0% and 1.8%, respectively.

Ship Strikes

Ship strikes were implicated in the deaths of at least two humpback whales in 1993, one in 1995, and one in 2000 (J. Cordaro, NMFS unpubl. data). During ~~1998-2002~~ 1999-2003, there were an additional ~~4~~ 5 injuries and 2 mortalities of unidentified large whales attributed to ship strikes. Additional mortality from ship strikes probably goes unreported because the whales do not strand or, if they do, they do not have obvious signs of trauma. Several humpback whales have been photographed in California with large gashes in their dorsal surface that appear to be from ship strikes (J. Calambokidis, pers. comm.). The average number of humpback whale deaths by ship strikes for ~~1998-2002~~ 1999-2003 is at least 0.2 per year.

Other human-caused mortality

A humpback whale died and stranded near Moss Landing in 2000 with synthetic (possibly nylon) line wrapped around its flukes. The origin of this line (fishery or other anthropogenic source) is unknown. The average number of humpback deaths from unknown anthropogenic sources is 0.2 per year from ~~1998-2002~~1999-2003.

STATUS OF STOCK

Humpback whales in the North Pacific were estimated to have been reduced to 13% of carrying capacity (K) by commercial whaling (Braham 1991). Clearly the North Pacific population was severely depleted. The initial abundance has never been estimated separately for the eastern North Pacific stock, but this stock was also depleted (probably twice) by whaling (Rice 1974; Clapham et al. 1997). Humpback whales are formally listed as "endangered" under the Endangered Species Act (ESA), and consequently the California/Mexico stock is automatically considered as a "depleted" and "strategic" stock under the MMPA. The estimated annual mortality and injury due to entanglement (~~0.8~~1.2/yr), other anthropogenic sources (0.2/yr), plus ship strikes (0.2/yr) in California is less than the PBR allocation of ~~1.6~~2.3 for U.S. waters. ~~In a review of the severity of injury to the humpback whale entangled in 1997, the Pacific Scientific Review Group determined that this animal was not seriously injured.~~ The three humpbacks that were ~~observed to be~~ entangled at sea may have been seriously injured. Based on strandings and gillnet observations, annual humpback whale mortality and serious injury in California's drift gillnet fishery is probably greater than 10% of the PBR; therefore, total fishery mortality may not be approaching zero mortality and serious injury rate. The eastern North Pacific stock appears to be increasing in abundance. The increasing levels of anthropogenic noise in the world's oceans, such as those produced by ATOC (Acoustic Thermometry of Ocean Climate) or LFA (Low Frequency Active) Sonar, have been suggested to be a habitat concern for whales, particularly for baleen whales that may communicate using low-frequency sound.

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Revised ~~03/15/2005~~ 05/15/2005

FALSE KILLER WHALE (*Pseudorca crassidens*): Hawaiian Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

False killer whales are found worldwide mainly in tropical and warm-temperate waters (Stacey et al. 1994). In the North Pacific, this species is well known from southern Japan, Hawaii, and the eastern tropical Pacific. Most knowledge about this species comes from outside Hawaiian waters (Stacey et al. 1994). There are six stranding records from Hawaiian waters (Nitta 1991; Maldini 2005). Two sightings of false killer whales were made during a 2002 shipboard survey of waters within the U.S. Exclusive Economic Zone (EEZ) of the Hawaiian Islands (Figure 1; Barlow 2003). Smaller-scale surveys conducted around the Main Hawaiian Islands (Figure 2) show that false killer whales are also commonly encountered in nearshore waters (Baird et al. 2005, Mobley et al. 2000, Mobley 2001, 2002, 2003, 2004).

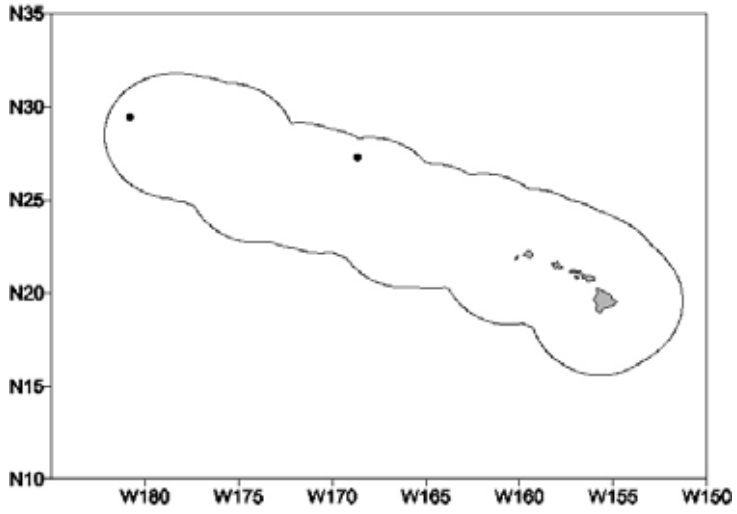

Figure 1. False killer whale sighting locations during the 2002 shipboard survey of U.S. EEZ waters surrounding the Hawaiian Islands (Barlow 2003; see Appendix 2 for details on timing and location of survey effort). Outer line represents approximate boundary of survey area and U.S. EEZ.

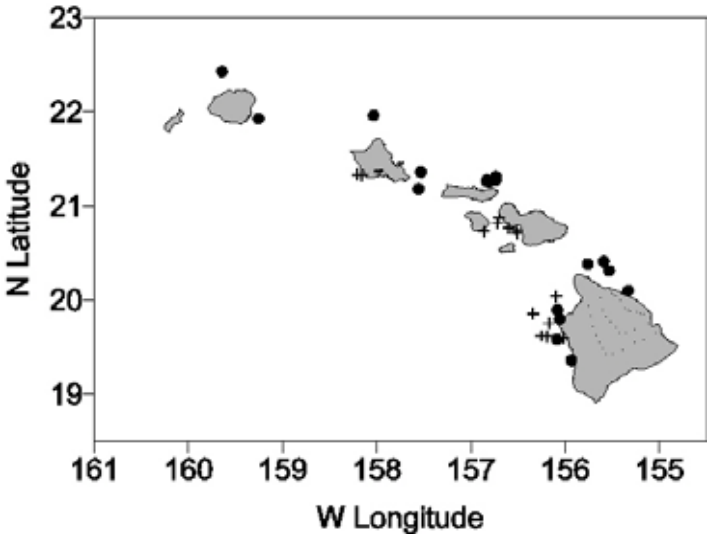

Figure 2. False killer whale sighting locations during 2000-2004 boat-based surveys (+) (Baird et al. 2005) and 1993-2003 aerial surveys (•) (Mobley et al. 2000, Mobley 2001, 2002, 2003, 2004) around the Main Hawaiian Islands. See Appendix 2 for details on timing and location of survey effort.

Genetic analyses of tissue samples collected near the main Hawaiian Islands indicate that Hawaiian false killer whales are reproductively isolated from false killer whales found in the eastern tropical Pacific Ocean (S. Chivers, NMFS/SWFSC, unpublished data); however, the offshore range of this Hawaiian population is unknown. Fishery interactions with false killer whales demonstrate that this species also occurs in U.S. EEZ waters around Palmyra ~~Island~~ Atoll (Figure 2), but it is not known whether these animals are part of the Hawaiian stock or whether they represent a separate stock of false killer whales. Based on patterns of movement and population structure observed in other island-associated cetaceans (Norris and Dohl 1980; Norris et al.1994; Baird et al. 2001, 2003; S. Chivers, pers. comm.), the animals around Palmyra ~~Island~~ Atoll may represent a separate stock. Unconfirmed sightings of false killer whales have also been reported near Johnston Atoll and require further investigation (NMFS/PIR, unpublished data). Efforts are currently underway to obtain additional tissue samples of false killer

whales for further studies of population structure in the North Pacific Ocean. For the Marine Mammal Protection Act (MMPA) stock assessment reports, there is currently a single Pacific management stock including animals found within the U.S. EEZ of the Hawaiian Islands. Information on false killer whales around Palmyra ~~Island~~ Atoll will provisionally be included with this stock assessment report, recognizing that separate stock status may be warranted for these animals in the future. Estimates of abundance, potential biological removals, and status determinations will be presented separately for U.S. EEZ waters of the Hawaiian Islands and Palmyra ~~Island~~ Atoll.

POPULATION SIZE

Population estimates for this species have been made from shipboard surveys in Japan (Miyashita 1993) and the eastern tropical Pacific (Wade and Gerrodette 1993), but evidence suggests that false killer whales around Hawaii form a distinct population (S. Chivers, NMFS/SWFSC, unpublished data). As part of the Marine Mammal Research Program of the Acoustic Thermometry of Ocean Climate (ATOC) study, a total of twelve aerial surveys were conducted within about 25 nmi of the main Hawaiian Islands in 1993, 1995 and 1998. An abundance estimate of 121 (CV=0.47) false killer whales was calculated from the combined survey data (Mobley et al. 2000). This study underestimated the total number of false killer whales within the U.S. EEZ off Hawaii, because areas around the Northwestern Hawaiian Islands (NWHI) and beyond 25 nautical miles from the main islands were not surveyed and estimates were uncorrected for the proportion of diving animals missed from the survey aircraft. Furthermore, the data on which this estimate was based are now over 5 years old. A 2002 shipboard line-transect survey of the entire Hawaiian Islands EEZ resulted in an abundance estimate of 268 (CV=1.08) false killer whales (Barlow 2003). This is the best available abundance estimate for false killer whales within the Hawaiian Islands EEZ.

No abundance estimates are currently available for false killer whales in U.S. EEZ waters of Palmyra ~~Island~~ Atoll; however, density estimates for false killer whales in other Pacific regions can provide a range of likely abundance estimates in this unsurveyed region. Published estimates of false killer whale density (animals per km^2) in the Pacific are: 0.0001 (CV=1.08) for the U.S. EEZ of the Hawaiian Islands (Barlow 2003); 0.0017 (CV=0.47) for nearshore waters surrounding the main Hawaiian Islands (Mobley et al. 2000), 0.0021 (CV=0.64) and 0.0016 (CV=0.31) for the eastern tropical Pacific Ocean (Wade and Gerrodette 1993; Ferguson and Barlow 2003), and 0.0033 (CV=0.56) for the eastern tropical Pacific Ocean west of 120°W and north of 5°N (Ferguson and Barlow 2003). Applying the lowest and highest of these density estimates to U.S. EEZ waters surrounding Palmyra ~~Island~~ Atoll (area size = 347,216 km^2) yields a range of plausible abundance estimates of 42 - 1,160 false killer whales.

Minimum Population Estimate

The log-normal 20th percentile of the 2002 abundance estimate for the Hawaiian Islands EEZ (Barlow 2003) is 128 false killer whales. No minimum population estimate is currently available for waters surrounding Palmyra ~~Island~~ Atoll, but the false killer whale density estimates from other Pacific regions (Barlow 2003, Mobley et al. 2000, Wade and Gerrodette 1993, Ferguson and Barlow 2003; see above) can provide a range of likely values. The lognormal 20^{th} percentiles of plausible abundance estimates for the Palmyra ~~Island~~ Atoll EEZ, based on the densities observed elsewhere, range from 20 - 746 false killer whales.

Current Population Trend

No data are available on current population trend.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

No data are available on current or maximum net productivity rate for this species in Hawaiian waters.

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for the Hawaiian false killer whale stock is calculated as the minimum population size (128) times one half the default maximum net growth rate for cetaceans (½ of 4%) times a recovery factor of ~~0.40~~ 0.45 (for a stock of unknown status with a Hawaiian Islands EEZ mortality and serious injury rate CV ~~> 0.80~~ between 0.60 and 0.80; Wade and Angliss 1997), resulting in a PBR of ~~1.0~~ 1.2 false killer whales per year. No separate PBR can presently be calculated for false killer whales within the Palmyra ~~Island~~ Atoll EEZ, but based on the range of plausible minimum abundance estimates (20 - 746), a recovery factor of ~~0.45~~ 0.48 (for a species of unknown status with a fishery mortality and serious injury rate CV between 0.30 and 0.60 ~~and 0.80~~ within the Palmyra ~~Island~~ Atoll EEZ; Wade and Angliss 1997), and the default growth rate (½ of 4%), the PBR would likely fall between 0.2 and ~~6.7~~ 7.2 false killer whales per year.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fishery Information

Information on fishery-related mortality of cetaceans in Hawaiian waters is limited, but the gear types used in Hawaiian fisheries are responsible for marine mammal mortality and serious injury in other fisheries throughout U.S. waters. Gillnets appear to capture marine mammals wherever they are used, and float lines from lobster traps and longlines can be expected to occasionally entangle whales (Perrin et al. 1994). In Hawaii, no mortality of false killer whales has been observed in inshore gillnets, but these fisheries are not observed or monitored.

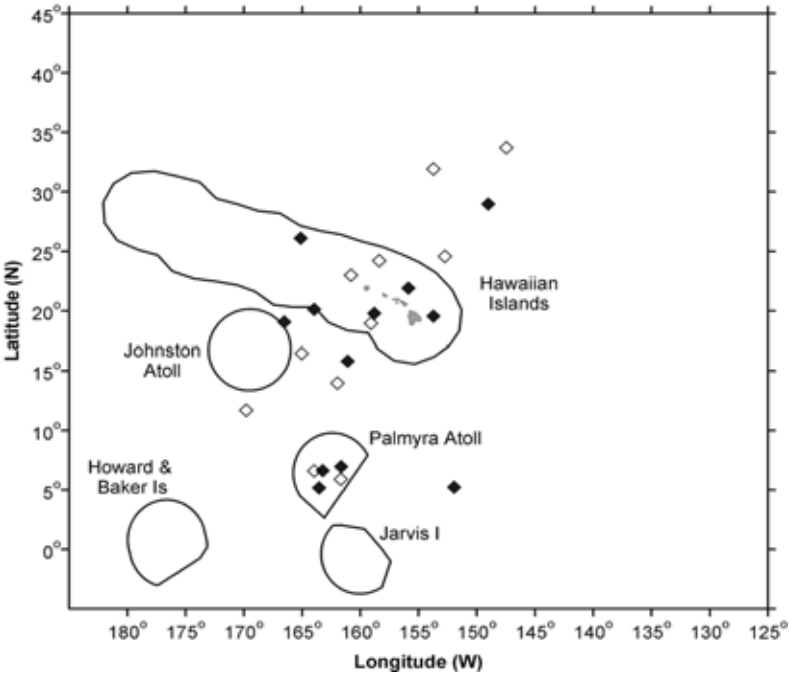

Figure 3. Locations of observed false killer whale takes (filled diamonds) and possible takes of this species (open diamonds) in the Hawaii-based longline fishery, 1994-2003 ~~2002~~. Solid lines represent the U.S. EEZ. Set locations in this fishery are summarized in Appendix 1.

Interactions with cetaceans have been reported for all Hawaiian pelagic fisheries, and false killer whales have been identified in fishermen's logs and NMFS observer records as taking catches from pelagic longlines (Nitta and Henderson 1993, NMFS/PIR unpublished data). They have also been observed feeding on mahi mahi, *Coryphaena hippurus*, and yellowfin tuna, *Thunnus albacares*, and frequently steal large fish (up to 70 pounds) (Shallenberger 1981) from the trolling lines of both commercial and recreational fishermen (S. Kaiser, pers. comm.).

Between 1994 and ~~2002~~ 2003, ~~ten~~ 12 false killer whales were observed hooked in the Hawaii-based longline fishery with approximately 4-25% of all effort observed (Table 1; Forney and Kobayashi 2005). ~~Seven~~ Eleven additional unidentified cetaceans, which may have been false killer whales, were also taken in this fishery (Figure ~~2~~3, Forney and Kobayashi 2005 ~~2004~~). During the ~~905 observed trips with 11,014~~ 15,859 observed sets, the average interaction rate of false killer whales was 1.01 false killer whales per 1000 sets ~~one animal per 91 fishing trips, or one animal per 1,101 sets~~. All false killer whales caught were considered seriously injured (Forney and Kobayashi 2005 ~~2004~~), based on an evaluation of the observer's description of the interaction and following established guidelines for assessing serious injury in marine mammals (Angliss and DeMaster 1998). Average 5-yr estimates of annual mortality and serious injury for ~~1998-2002~~1999-2003 are ~~4.8 (CV = 0.49)~~ 4.2 (CV = 0.45) false killer whales outside of U.S. EEZs, ~~4.4 (CV = 1.00)~~ 1.6 (CV = 0.71) within the Hawaiian Islands EEZ, and ~~2.4 (CV = 0.61)~~ 1.8 (CV = 0.59) within the EEZ of Palmyra ~~Island~~ Atoll (Table 1). Total estimated annual mortality and serious injury for all U.S. EEZs combined averaged ~~6.8 (CV = 0.60)~~ 3.4 (CV = 0.33) between ~~1998~~ 1999 and ~~2002~~ 2003. Since 2001, the Hawaii-based longline fishery has undergone a series of regulatory changes, primarily to protect sea turtles (NMFS 2001). Potential impacts of these regulatory changes on the rate of false killer whale interactions are unknown.

Interaction rates between dolphins and the NWHI bottomfish fishery have been estimated based on studies conducted in 1990-1993, indicating that an average of 2.67 dolphin interactions, most likely involving bottlenose and rough-toothed dolphins, occurred for every 1000 fish brought on board (Kobayashi and Kawamoto 1995). Fishermen claim interactions with dolphins that steal bait and catch are increasing. It is not known whether these interactions result in serious injury or mortality of dolphins, nor whether false killer whales are involved.

STATUS OF STOCK

The status of false killer whales in Hawaiian waters relative to OSP is unknown, and there are insufficient data to evaluate trends in abundance. No habitat issues are known to be of concern for this species. They are not listed as "threatened" or "endangered" under the Endangered Species Act (1973), nor as "depleted" under the MMPA. Because the rate of mortality and serious injury to false killer whales within the Hawaiian Islands EEZ in

the Hawaii-based longline fishery (~~4.4~~ 1.6 animals per year) exceeds the PBR (~~1.0~~ 1.2), this stock is considered a strategic stock under the 1994 amendments to the MMPA. The total fishery mortality and serious injury for Hawaiian false killer whales cannot be considered to be insignificant and approaching zero, because it exceeds the PBR. Although no estimates of abundance or PBR are currently available for false killer whales around Palmyra ~~Island~~ Atoll, the average rate of mortality and serious injury within the Palmyra ~~Island~~ Atoll EEZ (~~2.4~~ 1.8 animals per year) falls within the range of likely PBRs (0.2 to ~~6.7~~ 7.2) for this region.

Table 1. Summary of available information on incidental mortality and serious injury of false killer whales (Hawaiian stock) in commercial fisheries, within and outside of U.S. EEZs (Forney and Kobayashi 2005 ~~2004~~). Mean annual takes are based on ~~1998-2002~~ 1999-2003 data unless otherwise indicated.

Fishery Name	Year	Data Type	Percent Observer Coverage	Observed and estimated mortality and serious injury of false killer whales, by EEZ region								
				Outside of U.S. EEZs			Hawaiian Islands EEZ			Palmyra Atoll EEZ		
				Obs.	Estimated (CV)	Mean Annual Takes (CV)	Obs.	Estimated (CV)	Mean Annual Takes (CV)	Obs.	Estimated (CV)	Mean Annual Takes (CV)
Hawaii-based longline fishery	~~1998~~	observer data	~~4.6%~~	~~0~~	~~0 ( )~~	~~4.8 (0.49)~~ 4.2 (0.45)	~~1~~	~~22 (1.00)~~	~~4.4 (1.00)~~ 1.6 (0.71)	~~0~~	~~0 ( )~~	~~2.4 (0.61)~~ 1.8 (0.59)
	1999		~~3.5~~ 3.6%	0	0 (-)		0	0 (-)		0	0 (-)	
	2000		~~11.8~~11.1%	~~1~~0	~~8 (1.00)~~ 0 (-)		0	0 (-)		0	0 (-)	
	2001		~~22.7~~23.0%	~~1~~2	~~4 (1.00)~~ 10 (0.71)		0	0 (-)		1	4 (1.00)	
	2002		~~24.9~~24.8%	3	~~12 (0.58)~~ 11 (0.58)		0	0 (-)		~~8~~ 5 (0.71)		
	2003		21.9%	0	0 (-)		2	8 (0.71)		0	0 (-)	
Minimum total annual takes within U.S. EEZ waters							3.4 (0.33)					

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Revised 05/01/2005 **Appendix 1. Description of U.S. Commercial Fisheries**

The Marine Mammal Protection Act (MMPA) requires NMFS to publish a list of commercial fisheries (List Of Fisheries or "LOF") and classify each fishery based on whether incidental mortality and serious injury of marine mammals is frequent (Category I), occasional (Category II), or unlikely or unknown (Category III). The LOF is published annually in the Federal Register. The categorization of a fishery in the LOF determines whether participants in that fishery are subject to certain provisions of the MMPA, such as registration, observer coverage, and take reduction plan requirements. The categorization criteria as they appear in the LOF is reprinted below:

The fishery classification criteria consist of a two-tiered, stock-specific approach that first addresses the total impact of all fisheries on each marine mammal stock, and then addresses the impact of individual fisheries on each stock. This approach is based on consideration of the rate, in numbers of animals per year, of incidental mortalities and serious injuries of marine mammals due to commercial fishing operations relative to the Potential Biological Removal (PBR) level for each marine mammal stock. The MMPA (16 U.S.C. 1362 (20)) defines the PBR level as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population. This definition can also be found in the implementing regulations for section 118 at 50 CFR 229.2.

Tier 1: If the total annual mortality and serious injury across all fisheries that interact with a stock is less than or equal to 10 percent of the PBR level of the stock, all fisheries interacting with the stock would be placed in Category III. Otherwise, these fisheries are subject to the next tier (Tier 2) of analysis to determine their classification.

Tier 2, Category I: Annual mortality and serious injury of a stock in a given fishery is greater than or equal to 50 percent of the PBR level.

Tier 2, Category II: Annual mortality and serious injury of a stock in a given fishery is greater than 1 percent and less than 50 percent of the PBR level.

Tier 2, Category III: Annual mortality and serious injury of a stock in a given fishery is less than or equal to 1 percent of the PBR level.

While Tier 1 considers the cumulative fishery mortality and serious injury for a particular stock, Tier 2 considers fishery-specific mortality and serious injury for a particular stock. Additional details regarding how the categories were determined are provided in the preamble to the final rule implementing section 118 of the MMPA (60 FR 45086, August 30, 1995). Since fisheries are categorized on a per-stock basis, a fishery may qualify as one Category for one marine mammal stock and another Category for a different marine mammal stock. A fishery is typically categorized on the LOF at its highest level of classification (e.g., a fishery that qualifies for Category III for one marine mammal stock and for Category II for another marine mammal stock will be listed under Category II).

Other Criteria That May Be Considered

In the absence of reliable information indicating the frequency of incidental mortality and serious injury of marine mammals by a commercial fishery, NMFS will determine whether the incidental serious injury or mortality qualifies for Category II by evaluating other factors such as fishing techniques, gear used, methods used to deter marine mammals, target species, seasons and areas fished, qualitative data from logbooks or fisher reports, stranding data, and the species and distribution of marine mammals in the area, or at the discretion of the Assistant Administrator for Fisheries (50 CFR 229.2).

This appendix describes commercial fisheries that occur in California, Oregon, Washington, and Hawaiian waters and that interact or may interact with marine mammals. The first three sections describe sources of marine mammal mortality data for these fisheries. The fourth section describes the commercial fisheries for these states. A list of all known fisheries for these states was published as a proposed rule in the Federal Register, ~~vol. 68, no. 135 dated 15 July 2003~~ vol. 69 no. 231 dated 02 December 2004.

Revised 05/01/2005 **Appendix 1. Description of U.S. Commercial Fisheries**

1. Sources of Mortality/Injury Data

There are three major sources of marine mammal mortality/injury data for the active commercial fisheries in California, Oregon, and Washington. These sources are the NMFS Observer Programs, the Marine Mammal Authorization Program (MMAP) data, and the NMFS Marine Mammal Stranding Network (MMSN) data. Each of these data sources has a unique objective. Data on mammal mortality and injury are reported to the MMAP by fishers in any commercial fisheries. Marine mammal mortality and injury is also monitored by the NMFS Marine Mammal Stranding Network (MMSN). Data provided by the MMSN is not duplicated by either the NMFS Observer Program or MMAP reporting. Human-related data from the MMSN include occurrences of mortality due to entrainment in power station intakes, ship strikes, shooting, evidence of net fishery entanglement (net remaining on animal, net marks, severed flukes), and ingestion of hooks.

2. Marine Mammal Reporting from Fisheries

In 1994, the MMPA was amended to implement a long-term regime for managing mammal interactions with commercial fisheries (the Marine Mammal Authorization Program, or MMAP). Logbooks are no longer required - instead vessel owners/operators in any commercial fishery (Category I, II, or III) are required to submit one-page pre-printed reports for all interactions (including those that occur while an observer is onboard) resulting in an injury or mortality to a marine mammal. The report must include owner/operator's name and address, vessel name and ID, where and when the interaction occurred, the fishery, species involved, and type of injury (if the animal was released alive). These postage-paid report forms are mailed to all Category I and II fishery participants that have registered with NMFS, and must be completed and returned to NMFS within 48 hours of returning to port for trips in which a marine mammal injury or mortality occurred. The number of self-reported marine mammal interactions is considerably lower than the number reported by fishery observers, even though observer reports are typically based on 20% observer effort. For example, from 1998-2002, there were 115 fisher self-reports of marine mammal interactions in the California swordfish/thresher shark drift gillnet fishery. This compares with 201 observed interactions over the same period, based on only 20% observer coverage. This suggests that fisher self-reports are grossly underreported.

3. NMFS Marine Mammal Stranding Network data

In California, for the years 1998 through 2002 there were 120, 154, 152, 100, and 183 cetacean strandings respectively and 3568, 1066, 1857, 1482, and 2,367 pinniped strandings respectively. In Oregon/Washington from 1998-2002, there were 43, 50, 48, 28, and 17 reported cetacean strandings and 321, 267, 235, 250, 139 pinniped strandings, respectively. Approximately 10% of all cetacean and 7% of all pinniped strandings showed evidence of human-caused mortality during this period. Human-related causes of mortality include: entrainment in power station intakes, shooting, net fishery entanglement, and hook/line, set-net and trap fishery interaction. A species summary of all cetacean and pinniped strandings for the period 1998-2002 is given in Table 2 of this Appendix.

4. Fishery Descriptions

Category ~~II~~ I, CA/OR thresher shark/swordfish drift gillnet fishery (≥14 inch mesh)

Note: ~~This fishery was previously classified as a Category I fishery.~~ NMFS has proposed reclassifying this fishery to a Category I, based on a revised PBR level for short-finned pilot whales and an observed take of a short-finned pilot whale in this fishery in 2003 (Federal Register vol. 69 no. 231 dated 02 December 2004).

Number of permit holders: The number of eligible permit holders in California for 1998-2002 are 148, 136, 126, 113, and 105, respectively.

Number of active permit holders: The number of vessels active in this fishery from 1998-2002 were 123, 96, 81, 65, and 56, respectively.

Total effort: Both estimated and observed effort for the drift-net fishery during the calendar years 1990 through 2002 are shown in Figure 7. In 2002 there was an estimated 1,630 effort-days, where an effort-day is defined to be one day of effort by one vessel. (In this fishery, 1 effort-day is equivalent to 1 set.). There were 360 (64 trips) observed effort-days in 2002.

Geographic range: Effort in this fishery ranges from the U.S./Mexico border north to waters off the state of Oregon. For this fishery there are area-season closures (see below). Figures 1-5 show locations of observed sets and Figure 6 shows approximate locations of observed marine mammal entanglements for the period 1998-2002.

Seasons: This fishery is subject to season-area restrictions. From February 1 to May 15 effort must be further than 200 nautical miles (nmi) from shore; from May 16 to August 14, effort must be further than 75 nmi from shore, and from August 15 to January 31 there is only the 3 nmi off-shore restriction for all gillnets in southern California (see angel shark/halibut fishery below). The majority of the effort occurs from October through December. A season-area closure to protect leatherback sea turtles was implemented in this fishery in August 2001. The closure area prohibits drift gillnet fishing from August 15 through November 15, in the area bounded by straight lines from Point Sur, California (N36^{o} 17') to N 34^{o} 27' W 123^{o} 35', west to W129^{o}, north to N 45^{o}, then east to the Oregon coast. The Highly Migratory Species Management Team of the Pacific Fishery Management Council is considering re-opening the area south of Point Sur, California in this fishery. An additional season-area closure south of Point Conception and east of W120 degrees longitude is effective during the months of June, July, and August during El Niño years to protect loggerhead turtles (Federal Register, Vol 68, No 241, 16 December 2003).

Gear type and fishing method: Typical gear used for this fishery is a 1000 fathom gillnet with a stretched mesh size typically ranging from 18-22 inches (14 inch minimum). The net is set at dusk and allowed to drift during the night after which, it is retrieved. The fishing vessel is typically attached to one end of the net. Soak duration is typically 12-14 hours depending on the length of the night. Net extender lengths of a minimum 36 ft. became mandatory for the 1997-1998 fishing season. The use of acoustic warning devices (pingers) became mandatory 28 October 1997.

Regulations: ~~This fishery is managed by the California Dept. of Fish and Game and by Oregon Dept. of Fish and Wildlife in accordance with state and federal laws.~~ The fishery is managed under a Fishery Management Plan (FMP) administered by the Pacific Fishery Management Council.

Management type: The drift-net fishery is a limited entry fishery with seasonal closures and gear restrictions (see above). The state of Oregon restricts landing to swordfish only.

Comments: This fishery has had a NMFS observer program in place since July 1990. Due to bycatch of strategic stock including short-finned pilot whale, beaked whales, sperm whale and humpback whale, a Take Reduction Team was formed February 12, 1996. Since then, the implementation of increased extender lengths and the deployment of pingers has substantially decreased cetacean entanglement. ~~This fishery was reclassified from a Category I to a Category II fishery in 2003 (Federal Register, Vol. 68, No. 135, 15 July 2003).~~ The fraction of active vessels in this fishery that are not observed owing to a lack of berthing space for observers has been increasing as larger vessels drop out of this fishery.

Category I, CA angel shark/halibut and other species set gillnet fishery (>3.5 inch mesh).

Note: The "**CA angel shark/halibut set gillnet fishery**" and "**CA other species, large mesh (>3.5 in) set gillnet fishery**" were previously listed as separate fisheries. Angel shark and halibut are typically targeted using 8.5 inch mesh while the remainder of the fishery targets white seabass and yellowtail using 6.5 inch mesh. In recent years, there has been an increasing number of 6.0-6.5 inch mesh sets fished using drifting methods; this component is now identified as a separate fishery (see "**CA yellowtail, barracuda, white seabass, and tuna drift gillnet fishery (>3.5 and <14 in mesh)**" fishery described below).

Number of permit holders: There is no specific permit category for this fishery. Overall, the current number of legal permit holders for gill and trammel nets, excluding swordfish drift gillnets and herring gillnets for 1998 through 2002 are, respectively, 255, 245, 232, 223, and 209.

Number of active permit holders: For the period 1998-2001, there were 45, 66, 62, 57, and 52 active permit holders in this fishery.

Total effort: Effort in the angel shark/halibut set-net fishery has historically been as high as 7,000 days in 1991, declined to fewer than 2,000 days following a gillnet closure within 3 nautical miles of the mainland and 1 nmi of the Channel Islands in 1994, and has been steady at about 3,000-4,000 days in the last five years. A summary of estimated fishing effort and observer coverage for the years 1990-2002 is shown in Figure 8. Effort in the white seabass and yellowtail portion of this fishery from 1998 to 2002 were 761, 460, 657, 551, and 733 days, respectively. For the first two quarters of 2003, there were 366 days fished. A portion of the effort in the white seabass and yellowtail fishery utilizes drifting nets (see "CA yellowtail, barracuda, white seabass, and tuna drift gillnet fishery (>3.5 and <14 in mesh)" fishery description below).

Geographic range: Effort in this fishery previously ranged from the U.S./Mexico border north to Monterey Bay and was localized in more productive areas: San Ysidro, San Diego, Oceanside, Newport, San Pedro, Ventura, Santa Barbara, Morro Bay, and Monterey Bay. Fishery effort is now predominantly in the Ventura Flats area off of Ventura, the San Pedro area between Pt. Vicente and Santa Catalina Island and in the Monterey Bay area. The central California portion of the fishery from Point Arguello to Point Reyes has been closed since September 2002 when a ban on gillnets inshore of 60 fathoms took effect.

Seasons: This fishery operates year round. Effort generally increases during the summer months and declines during the last three months of a year.

Gear type and fishing method: Typical gear used for this fishery is a 200 fathom gillnet with a stretched mesh size of 8.5 inches. The component of this fishery that targets white seabass and yellowtail utilizes 6.5 inch mesh. The net is generally set during the day and allowed to soak for up to 2 days. Soak duration is typically 8-10, 19-24, or 44-49 hours. The depth of water ranges from 15-50 fathoms with most sets in water depths of 15-35 fathoms.

Regulations: This fishery is managed by the California Dept. of Fish and Game in accordance with state and federal laws.

Management type: The halibut/angel shark set-net fishery is a limited entry fishery with gear restrictions and area closures.

Comments: An observer program for the halibut/angel shark portion of this fishery operated from 1990-94 and was discontinued after area closures were implemented in 1994, which prohibited gillnets within 3 nmi of the mainland and within 1 nmi of the Channel Islands in southern California. NMFS re-established an observer program for this fishery in Monterey Bay in 1999-2000 due to a suspected increase in harbor porpoise mortality in Monterey Bay. In 1999 and 2000, fishery mortality exceeded PBR for the Monterey Bay harbor porpoise stock, and the stock is currently designated as strategic. In the autumn of 2000, the California Department of Fish and Game implemented the first in a series of emergency area closures to set gillnets within 60 fathoms along the central California coast. This effectively reduced fishing effort to negligible levels in 2001 and 2002 in Monterey Bay. A ban on gill and trammel nets inside of 60 fathoms from Point Reyes to Point Arguello became effective in September 2002.

Category ~~III~~ I, Hawaii swordfish, tuna, billfish, mahi mahi, wahoo, and oceanic shark longline/set line fishery.[1]

Note: The classification of this fishery was elevated to Category I in 2004 based on revised PBR levels of false killer whales and observed false killer whale mortalities in this fishery (Federal Register Vol. 69 No. 153, dated 10 August 2004).

Number of permit holders: ~~There are 164 permits under a (1994) federal limited entry program.~~ The number of Hawaii longline limited access permit holders is 164. Not all such permits are renewed and used every year (approximately 126 were renewed in 2003). Most holders of Hawaii longline limited access permits are based in, or operate out of, Hawaii**.** Longline general permits are not limited by number. Approximately 67 longline general

[1] This fishery description was provided in part by Chris Yates (NMFS) and from published fishery regulations in the Federal Register Vol. 69. No. 153, dated 10 August 2004.

permits were issued in 2003, about 48 of which were active. In 2003 all but two holders of longline general permits were based in, or operated out of, American Samoa. The remaining two, neither of which was active in 2003, were based in the Mariana Islands (Federal Register 2 April 2004, Volume 69 Number 64).

Number of active permit holders: From 1998-2002 there were 115, 122, 125, 101, and 102 vessels actively fishing, respectively. There were 126 permits renewed in 2003 (Federal Register 2 April 2004, Volume 69 Number 64). In 2004, there were 125 Hawaii longline limited access permits renewed, with 119 active. In 2004, there were 40 active permits in American Samoa.

Total effort: For the years 1998-2002, there were 1,181, 1,165, 1,135, 1,075, and 1,193 trips made respectively. The number of hooks set has steadily increased since 1997 (15.5 million) and peaked in 2002 with 27 million hooks set. In 2002, most effort occurred within the U.S. EEZ (approximately 15 million hooks set), while 12 million hooks were set outside the U.S. EEZ. At Kingman Reef and Palmyra Atoll there were 2.1 million hooks set in 2002. In 2003, there were 1,214 trips recorded (with tuna as the target species). There were a total of 29.8 million hooks set in 2003, of these, 15 million occurred outside the U.S. EEZ, 11 million within the Main Hawaiian Islands EEZ, 2.7 million within the Northwest Hawaiian Islands EEZ, and the remaining 0.9 million within other U.S. possession EEZs. The preliminary estimate of hooks fished in 2004 is 32 million hooks. 2003 logbook data for American Samoa consisted of 932 trips by 51 vessels, which made 6,220 sets, with 14.2 million hooks fished. Preliminary logbook data from 2004 in American Samoa consists of 623 trips by 40 vessels, which made 4,804 sets, with 11.6 million hooks fished.

Geographic range: This fishery encompasses a huge geographic range extending North-South from 40° N to the equator and East-West from Kure Atoll to as far as 135° W. Fishing for swordfish generally occurs north of Hawaii, (as much as 2,000 miles from Honolulu), whereas fishing for tunas occurs around the Main Hawaiian Islands (MHI) and south of the Hawaiian Islands. ~~The fishery is closed north of the equator to swordfish-style fishing, while tuna-style fishing is permitted with certain time/area closures.~~ New regulations published in 2004 lift previous area closures north of the equator.

Seasons: This fishery operates year-round. Effort is generally lower in the third quarter of the year.

Gear type: ~~For swordfish, typically a 16-48 km monofilament line having as many as 700-1,000 branch lines (9-18 m long), one in five attached with a "lightstick" (to attract squid, which in turn attract swordfish) placed about 76 cm above the hook (usually baited with squid) is set in the evening and retrieved early the next morning. For tunas, a 32 km long main line, set during the day, is suspended from buoys and 1,000-1,400 dropper lines are attached to the main line each with a hook (usually baited with whole fish).~~ The basic unit of gear is the main line which is made of monofilament and stored on a large hydraulic reel. Eight hundred to 1000 hooks are attached to 30 to 40 miles of main line on a typical fishing day. Shallow sets for swordfish and deep sets for tuna are fished with a requirement that the fishermen must declare prior to departure which set type will be employed. (There was no Hawaii-based shallow set swordfish fishery from 2001-2003). All shallow swordfish sets are required to utilize size 18/0 circle hooks with a 10 degree offset and mackerel bait (the use of squid bait is prohibited). Deployment and retrieval of gear must occur at night. For deep sets, all float lines must be at least 20 meters in length; with a minimum of 15 branch lines between any two floats (except basket-style longline gear which may have as few as 10 branch lines between any two floats); without the use of light sticks; and resulting in the possession or landing of no more than 10 swordfish (Xiphias gladius) at any time during a given trip. As used in this definition ``float line" means a line used to suspend the main longline beneath a float and ``light stick" means any type of light emitting device, including any fluorescent ``glow bead", chemical, or electrically powered light that is affixed underwater to the longline gear (Federal Register 2 April 2004 Volume 69 Number 64). There are currently no Hawaii longline vessels deploying basket gear.

While similar, swordfish and tuna gear differ in the depth at which it is deployed, the number of hooks deployed, and the time of day at which it is set. Both styles use a monofilament mainline that is generally 3.2- 4.0 mm in diameter that is stored, deployed, and retrieved using a large hydraulic reel (some vessels may have two). In general, swordfish gear is deployed at an average depth (deepest) of 70m, with 600-1000 hooks deployed per day (3-6 hooks between floats), and the line is set at night and hauled during daylight hours. Additionally, float lines are

usually less than the required twenty meters (~10m) for tuna fishing. Because some swordfish vessels carry two reels of mainline, it is not uncommon for swordfish vessels to set as much as 60 miles of line in a day. In contrast, tuna gear is set much deeper (~200m), with 1500-2200 hooks deployed per day (20-35 hooks between floats), the line is set in the morning and hauled in the evening. In addition, tuna mainline is deployed using a hydraulic line shooter. Regulations permit a minimum of 15 hooks between floats. There is no minimum for trips targeting swordfish. The line shooter sends the line off the vessel faster than the vessel is moving creating deep arcing caternaries in the line. This allows them to target deep dwelling tunas. Swordfish mainline is set at the same speed as the vessel to keep the line in shallower depths. Finally, lightsticks are prohibited during tuna (deep set) fishing operations. These are allowed in the swordfish fishery.

The leaders attached to the mainline also differ between the two fisheries. A tuna leader is usually comprised of a hook immediately followed by a length of wire (1-2 mm thick) which is attached to a weighted swivel. The rest of the tuna leader in comprised of ~2mm thick monofilament and a snap for attachment to the mainline. The swordfish gear is comprised of a 18/0 or larger circle hook attached to a ~ 10m length of ~2mm monofilament line to a weighted swivel followed by another ~10m length of ~2mm monofilament. All attachments are made using loops secured by crimps.

Vessel operators are required to call NMFS for possible observer placement 72 hours prior to departure. At that time they must declare if they intend to go on a shallow-set or deep-set fishing trip. Regulations prohibiting the presence of lightsticks and float lines shorter than 20m aboard vessels on declared deep-set trips preclude fishermen from fishing trip types while at sea - additionally a vessel returning from a deep-set trip cannot land more than 10 swordfish (50 CFR 660.22).

Additional requirements for sea birds go into effect for vessels fishing above 23 degrees north latitude. New seabird regulations will take effect in 2005. Fishermen will be given a choice between side setting and employing a suite of seabird mitigation measures. Currently, regulations require deep-setting vessels to dye their bait blue, thoroughly thaw the bait, and throw all offal on the opposite side of the vessel from which fishing operations are taking place. (There have been no observations of marine mammals feeding on offal discarded from Hawaii-based longline vessels.) Additionally, these vessels are required to use a line shooter – which they would have anyway – and at least forty-five gram weights on the line.

Regulations: Effort is required to be outside of 50 nautical miles from the entire Northwestern Hawaiian islands (NWHI) because of possible protected species (monk seal) interactions. Several 25-75 mile closed areas also exist around the MHI to prevent gear conflicts with smaller fishing vessels. ~~This fishery currently operates under restrictions which prohibit swordfish style fishing methods (deepest hooks fished at depths < 100 m, use of lightsticks, setting at night) in an effort to reduce sea turtle mortality (NMFS Western Pacific Pelagic Fisheries Biological Opinion 2001). Other sea turtle bycatch reduction methods implemented include time and area closures for tuna style fishing methods, limited access permit restrictions, gear modification research, and skipper workshops aimed at reducing sea turtle interactions. Changes in this fishery have not been in place long enough to assess their influence on the rate of cetacean interactions.~~ Current regulations require 100% observer coverage for shallow swordfish sets and 20% observer coverage for deep tuna sets. There are fleet-wide annual limits on the number of allowable sea turtle interactions in this fishery (16 leatherbacks or 17 loggerheads). The shallow set component of the fishery is closed if either threshold is reached Federal Register: April 2, 2004 (Volume 69, Number 64). There is an annual limit of 2,120 shallow sets north of the equator. Vessel operators must obtain single shallow set certificates from NMFS, which are transferable, and valid for one calendar year. Hawaii-based longline vessels are prohibited from making more shallow-sets north of the equator during a trip than the number of valid shallow-set certificates on board the vessel. Within 72 hours of landing a pelagic management unit species, vessel operators are required to submit one valid shallow-set certificate to the Regional Adminstrator for every shallow set fished north of the equator during a fishing trip.

Management type: Federal limited access program. This fishery is managed under a Fishery Management Plan (FMP), by the Western Pacific Fishery Management Council.

Comments: This Hawaii longline fishery is active year-round and targets swordfish and tuna, other species are caught incidentally. ~~A small number of marine mammal~~ ~~I~~ Interactions with bottlenose dolphins, ~~and~~ false killer whales, humpback whales, short-finned pilot whales, spinner dolphins, short-beaked common dolphins, pantropical spotted dolphins, Blainville's beaked whale, sperm whales, and Risso's dolphins~~, and bottlenose dolphin~~ have been documented[2]. Longline hooks have also been recovered from Hawaiian monk seals, but these were not observed during longline fishing operations. ~~In 1998 interaction with one humpback whale was reported (NMFS logbook data) by a fisher. This may have been a result of the whale getting fouled in longline gear. No interactions with monk seals have been reported.~~ Due to interactions with protected species, especially turtles, this fishery has been observed since February 24, 1994. Initially, observer coverage was less than 5%, increased to 10% in 2000, and has exceeded 20% in 2001 and 2002. In 2003, observer coverage was 22.2% (based on vessel departures), with 6.4 million hooks observed from 3,204 sets. Observed injuries of marine mammals in this fishery in 2003 included 2 false killer whales, 1 unidentified cetacean and 1 unidentified whale. Additionally, there was one observed mortality of a bottlenose dolphin (Pacific Islands Regional Office preliminary report dated 9 February 2004). In 2004, observer coverage was 24.6% (based on vessel departures), with 7.9 million hooks observed from 3,958 sets. Observed injuries of marine mammals in this fishery in 2004 included 5 false killer whales, 1 humpback whale and 1 short-finned pilot whale. Additionally, there was one observed mortality of a false killer whale. In the shallow set component of this fishery, observer coverage in 2004 was 100% (88 sets and 76,750 hooks observed). No marine mammal interactions were observed in the shallow set component of the fishery (Pacific Islands Regional Office preliminary report dated 25 January 2005).

Category II, CA yellowtail, barracuda, white seabass, and tuna drift gillnet fishery (>3.5 and <14 in mesh)

Note: This fishery has developed recently as an offshoot of the "**CA other species, large mesh (>3.5 in) set gillnet fishery**" (see above). Fishermen use the same gear as in the set gillnet fishery (typically 6.5 inch mesh nets, 100-200 fathoms in length, except that they instead utilize drifting nets to target white seabass and yellowtail. Albacore tuna and barracuda are also targeted in this fishery.

Number of permit holders: There are approximately 24 active permit holders in this fishery.

Total effort: In the first two quarters of 2003, there were 366 days fished in the white seabass - yellowtail fishery. Of these 366 effort days, 69 days (19%) were drift sets, 267 (73%) were set gillnets, and 30 days (8%) were unspecified set type. In 2002, there were a total of 733 days fished in the white seabass - yellowtail fishery. Of these 733 effort days, 195 days (27 %) were drift sets, 447 days (61%) were set gillnets, and 91 days (12%) were unspecified set type.

Geographic range: This drift gillnet component of this fishery operates primarily south of Point Conception. Observed sets have been clustered around Santa Cruz Island, the east Santa Barbara Channel, and Cortez and Tanner Banks. Some effort has also been observed around San Clemente Island and San Nicolas Island.

Seasons: This fishery operates year round. Targeted species is typically determined by market demand on a short-term basis.

Gear type and fishing method: Typical gear used for this fishery is a 150-200 fathom gillnet, which is allowed to drift. The mesh size depends on the target species but typical values observed are 6.0 and 6.5 inches.

Regulations: This fishery is managed by the California Dept. of Fish and Game in accordance with state and federal laws.

Management type: This fishery is a limited entry fishery with gear restrictions and area closures.

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[2] K.A. Forney 2004. Estimates of cetacean mortality and injury in two U.S. Pacific longline fisheries, 1994-2002. Southwest Fisheries Science Center Administrative Report LJ-04-07, available from Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037. 17 pp.

Comments: This fishery primarily targets white seabass and yellowtail, but also targets barracuda and albacore tuna. For the period May 2001 through July 2003, there were 42 sets observed from 11 vessel trips. Observed mortality included one short-beaked common dolphin and 2 California sea lions. Also, 4 California sea lions were entangled and released alive during this period.

Category II, CA swordfish longline fishery

Number of permit holders: About 20-30 vessels based in California participate in the longline fishery.

Number of active permit holders: As of 2002, approximately 20-30 vessels participated in this fishery.

Total Effort: An estimated 1 - 1.5 million hooks are fished annually by 20-30 California-based vessels.

Geographic range: This fishery operates in west coast waters outside the 200 nm EEZ and unload their catch in California ports.

Seasons: The fishery operates year-round.

Gear type: Typically, vessels fish 24_72 km of mainline, rigged with 22 m gangions at approximately 60 m intervals. Anywhere from 800 to 1,300 hooks are deployed in a set, with large squid (Illex sp.) used for bait. Variously colored lightsticks are used, for fishing takes place primarily during the night, when more swordfish are available in surface waters. The mainline is deployed in 4_7 hours and left to drift unattached for 7_10 hours. Retrieval typically takes about 7_10 hours.

Regulations: Longline vessels are prohibited from operating within the 200 nmi limit, but may unload their catch in California ports and are required to have a California state commercial fishing license.

Management type: The California longline fishery is currently covered by a fishery management plan (FMP) that was submitted for Secretarial review in November 2003. The FMP was partially approved by NMFS on February 4, 2004. NMFS published a final rule on March 11, 2004 which prohibits shallow longline sets of the type normally targeting swordfish on the high seas in the Pacific Ocean east of 150^{o} W. longitude. The Pacific Fishery Management Council's Highly Migratory Species (HMS) Management Team is currently investigating scenarios under which swordfish may once again be targeted in this region with the adoption of gear modification measures (circle hooks and mackerel baits) used in the Atlantic that have been shown to significantly reduce takes of loggerhead and leatherback sea turtles. The HMS Management Team is also investigating options to create a limited-entry program for this fishery. A mandatory observer program became effective for this fishery in August 2002.

Comments: Many of the vessels in this fishery previously landed in Hawaii, but closures around the Hawaiian Islands have moved fishing effort farther east, and as a result some longline vessels now land in California. Preliminary catch data has been compiled for the California longline fishery from skipper logbooks, dated between August 1, 1995 and December 31, 1999. The logbooks do not report any whale or dolphin interactions, but do show interactions with California sea lions. Other documented bycatch in this fishery includes striped marlin, blue shark, seabirds, and sea turtles (Vojkovich and Barsky, 1998). Since 1993, the number of vessels in this fishery has increased, from 3 to the current estimate of 40-50. This increase in vessels initially resulted from the movement of vessels based in the Gulf of Mexico into southern California in the summer of 1993, and more recently from increased effort eastward by vessels originating in Hawaii, responding to a court injunction closing fishing areas around the Hawaiian islands. Approximately 40-50 longline vessels unload in California, and of these, 40 boats originated from Hawaii (and which also have Hawaii longline limited entry permits); these have unloaded their catch in California ports since December, 1999 (D. Petersen, NMFS, personal communication, April, 2000). Between October 2001 and November 2003, 19 trips were observed by California-based longline observers, with 391 sets observed (<15% observer coverage). Between October 2001 and November 2003, observed cetacean interactions have included one injured Risso's dolphin and one mortality of an unidentified dolphin.

Category II, California Round Haul Fisheries.

Note: This category includes purse seine, drum seine and lampara net fisheries for wetfish (anchovy, mackerel, and sardine), and tuna. Choice of targeted species is primarily driven by availability and varying market demand.

Number of permit holders: Number of permit holders is estimated at 150 for the wetfish fisheries (currently, tuna does not require a specific permit to operate other than a general commercial fishing permit). Starting January 1, 2000 under a new Coastal Pelagic Species Fishery Management Plan (CPS-FMP), a limited entry program was initiated for the area south of 39^{o} North latitude. Eligibility required a minimum of 100 metric tons of CPS finfish landed between January 1, 1993 through November 5, 1997.

Number of active permit holders: For the wetfish fishery, there are an estimated 65 vessels/persons actively fishing; for tuna, there are approximately 15 vessels/persons fishing.

Total effort: An estimated 70 vessels are eligible to fish under the limited entry permit requirements.

Geographic range: These fisheries occur along the coast of California predominantly from San Pedro, including the Channel Islands, north to San Francisco.

Seasons: This fishery operates year round. Targeted species vary seasonally with availability and market demand.

Gear type and fishing method: Purse seine, drum seine and lampara nets utilizing standard seining techniques.

Regulations: Starting on January 1, 2000 the wetfish fishery will be managed by PFMC in accordance with a CPS (coastal pelagic species) /FMP (fishery management plan) under federal laws.

Management type: The mackerel and sardine fisheries are quota fisheries. Several closures for both mackerel and sardine have been required by NMFS in recent years (mackerel 2001, 2002; sardine 2002, subarea closure) (pers. comm., Dale Sweetnam, California Department of Fish and Game).

Comments: Beginning in 1999 the sardine population is considered fully recovered since its collapse during the middle of the century. Typically, anchovy is targeted for bait or reduction while mackerel and sardine are destined for fresh fish, aquaculture or canning overseas.

Category II, WA Puget Sound Region salmon drift gillnet fishery.

Number of permit holders: This commercial fishery includes all inland waters south of the US-Canada border and east of the Bonilla/Tatoosh line, at the entrance to the Strait of Juan de Fuca. Treaty Indian salmon gillnet fishing is not included in this commercial fishery. In 1999, the U.S. and Canada reached an agreement that significantly reduced the U.S. share of sockeye salmon. In order to compensate the non-treaty U.S. fishermen for the impact of this reduction, a federally funded buyback program was established. By the 2001 fishing season, the number of available drift gillnet permits had been reduced from 675 (1999) to 216. The intent of the buyback program was to reduce the number of drift gillnet permits to 200 (pers. comm., David Cantillon, NMFS, Northwest Region).

Number of active permit holders: Under the cooperative program that integrates issuance of Marine Mammal Authorization Certificates into the existing State license process, NMFS receives data on vessels that have completed the licensing process and are eligible to fish. These vessels are a subset of the total permits extant (725 in 2001), and the remainder of the permits are inactive and do not participate in the fishery during a given year. The number of "active" permits is assumed to be equal to or less than the number of permits that are eligible to fish. From 1997-2001, the number of active permits was 633, 559, 199, 248, and 182, respectively.

Total effort: Effort in the Puget Sound salmon drift gillnet fishery is regulated by systematic openings and closures that are specific to area and target salmon species. Since 1994, the number of active vessels in the Puget Sound drift gillnet fishery has declined. In addition, at least one major portion of the fishery, the previously observed

sockeye fishery in areas 7 and 7A, has experienced reductions in available fishing time (openings). The number of days and total number of hours that the sockeye fishery remained open, approached the 1994 level only once (1997) in the period from 1995 through 1998. In the remaining years the available sockeye fishing time was less than half of the 1994 level. In recent years, poor sockeye returns and market conditions have combined to reduce participation in the fishery beyond the reductions created originally by the federal buyback program. In 2001, drift gillnets fished for only one opening and 182 gear units were fished in all areas as compared to the 559 cited for 1998. Owing to the buyback program and reduced salmon runs, it is expected that the number of active permits will remain low.

Geographic Range: The fishery occurs in the inland marine waters south of the U.S./Canada border and east of the Bonilla/Tatoosh line at the entrance to the Strait of Juan de Fuca. The inland waters are divided into smaller statistical catch areas which are regulated independently.

Seasons: This fishery has multiple seasons throughout the year that vary among local areas dependent on local salmon runs. The seasons are managed to access harvestable surplus of robust stocks of salmon while minimizing impacts on weak stocks.

Gear type and fishing methods: Vessels operating in this fishery use a drift gillnet of single web construction, not exceeding 300 fathoms in length. Minimum mesh size for gillnet gear varies by target species. Fishing directed at sockeye and pink salmon are limited to gillnet gear with a 5 inch minimum mesh and a 6 inch maximum, with an additional "bird mesh" requirement that the first 20 meshes below the corkline be constructed of 5 inch opaque white mesh for visibility; the chinook season has a 7 inch minimum mesh; the coho season has a 5 inch minimum mesh; and the chum season has a 6 to 6.25 inch minimum mesh. The depth of gillnets can vary depending upon the fishery and the area fished. Normally they range from 180 to 220 meshes in depth, with 180 meshes as a common depth. It is the intention of the fisher to keep the net off the bottom. The vessel is attached to one end of the net and drifts with the net. The entire net is periodically retrieved onto the vessel and catch is removed. Drift times vary depending on fishing area, tidal condition and catch.

Regulations: The fishery is a limited entry fishery with seasonal openings, area closures, and gear restrictions.

Management type: The fishery occurs in State waters and is managed by the Washington Department of Fish and Wildlife consistent with the U.S.-Canada Pacific Salmon Commission management regimes and the ocean salmon management objectives of the Pacific Fishery Management Council. U.S. and Canadian Fraser River sockeye and pink salmon fisheries are managed by the bilateral Fraser Panel in Panel Area waters. This includes the entire U.S. drift gillnet fishery for Fraser sockeye and pink salmon. For U.S. fisheries, Fraser Panel Orders are given effect by federal regulations that consist of In-season Orders issued by the NMFS Regional Administrator of the NMFS Northwest Region. These regulations are filed in the Federal Register post-season.

Comments: In 1993, observers were placed onboard vessels in a pilot program to monitor seabird and marine mammal interactions with fishing effort for several target salmon species in a number of areas throughout the Puget Sound region. In 1994 observer effort was concentrated in the sockeye fishery in areas 7 and 7A, where interactions with seabirds and marine mammals were most likely to occur. Incidental takes of harbor porpoise, Dall's porpoise and harbor seals have been documented in the fishery. The overall take of marine mammals for the salmon drift gillnet fisheries in Puget Sound is unlikely to have increased since the fisheries were last observed, owing to reductions in the number of participating vessels and available fishing time.

Category II, OR swordfish surface longline fishery.

Number of permit holders: The number of Oregon Developmental Fishery Permits for fishing swordfish using a floating longline is limited to 20. The number of permits issued for the period 1998-2002 (through May 2002) were 3, 4, 7, 2, and 3, respectively (pers. comm., Jane McCrae, Oregon Department of Fish and Wildlife, Marine Resources Program).

Number of active permit holders: Based on landings of swordfish with this gear type, there were no active permit holders in this fishery from 1997-2002.

Total effort: From 1997-2002, there were no reported swordfish landings using longline gear.

Geographic range: This fishery occurs off the coast of Oregon. Swordfish longlines may not be fished within 25 nautical miles of the mainland.

Seasons: This fishery could occur year-round, however, effort would generally terminate by late fall.

Gear type: Fishing gear consists of a buoyed mainline fitted with leaders and baited hooks. The mainline is fished near the surface suspended from buoys (rather than anchored to the bottom as in groundfish longline fisheries). Swordfish longlines may not exceed 1000 fathoms in length and must be attached at one end to the vessel when fishing. The gear is typically set in the evening and retrieved in the morning.

Regulations: The fishery is a limited entry fishery with gear and bycatch restrictions.

Management type: This fishery is managed by the Oregon Department of Fish and Wildlife, Developmental Fisheries Program.

Comments: The Developmental Fisheries Permit requires permit holders to take observers aboard if requested to do so, however, to date no observer placements have been made. No marine mammal interactions have been documented.

Category II, OR blue shark surface longline fishery.

Number of permit holders: The number of Oregon Developmental Fishery Permits for fishing blue shark using a floating longline is limited to 10. From 1997-2002, there were 4,0,0,4,1, and 3 permits issued for this fishery (pers. comm., Jane McCrae, Oregon Department of Fish and Wildlife, Marine Resources Program).

Number of active permit holders: There were no active permits in the blue shark longline fishery off Oregon from 1997 through mid-2002. The effort in this fishery prior to 1998 was estimated to be low based on the number of permits issued and very limited landings.

Total effort: Actual catch by the few developmental permit holders is unknown. Landings of blue shark by all vessels using longline gear totaled 3,628 pounds for the period 1995 through 1998 (477 lbs - '95, 871 lbs - '96, 542 lbs - '97, and 1,738 lbs - '98). Note that these landing totals are for all longline including blue shark landed incidental to the groundfish sunken longline fishery.

Geographic range: This fishery occurs off the coast of Oregon. There are no area restrictions for shark longline gear.

Seasons: This fishery occurs year-round, however, effort in this fishery generally terminates by late fall.

Gear type: Fishing gear consists of a buoyed mainline fitted with leaders and baited hooks. The mainline is fished near the surface suspended from buoys (rather than anchored to the bottom as in groundfish longline fisheries). Shark longlines must be marked at each terminal surface end with a pole and flag, an operating light, a radar reflector, and a buoy showing clear identification and gear owner. The gear is typically set in the evening and retrieved in the morning.

Regulations: The fishery is a limited entry fishery with gear and bycatch restrictions.

Management type: This fishery is managed by the Oregon Department of Fish and Wildlife, Developmental Fisheries Program.

Comments: The Developmental Fisheries Permit requires permit holders to take observers aboard if requested to do so, however, to date no observer placements have been made. No marine mammal interactions have been documented.

Category III, CA herring purse seine fishery.[3]

This fishery is composed of a roe herring fishery and a fresh herring fishery. The sac-roe fishery occurs in California's four largest herring spawning regions: San Francisco Bay, Tomales Bay, Humboldt Bay, and Crescent City Harbor. The largest spawning aggregations occur in San Francisco Bay and produces more than 90% of the herring catch. The four spawning areas are managed separately by the California Department of Fish and Game (CDFG); catch quotas are based on population estimates derived from acoustic and spawning-ground surveys. The roe herring component has recently undergone some changes. During the early 1990's, there were 26 permits fishing for roe herring using round hauls (either purse seine or lampara nets). Between 1993 and 1998, all roe herring fishers converted their gear to gillnets with stretched mesh size less than 2.5 inches (which are not known to take mammals) as part of CDFG efforts to protect herring resources. The sac-roe fishery is managed through a limited-entry program. Since 1983, only five new permits have been issued, and the number of annual permits has remained at about 450. This fishery begins in December (San Francisco Bay) or January (northern California) and ends when the quotas have been reached, but no later than mid-March. There are 10 permits available for the fresh herring round haul fishery (purse seine or lampara nets). This fishery is restricted to the non-spawning season, or approximately mid-March through the end of November. Fishing may take place in open ocean areas (e.g. Monterey Bay) or inside bays (e.g. San Francisco Bay).

[3] Pers. Comm. Diana Watters, biologist at CDFG Menlo Park.

Category II, CA squid purse seine fishery.[4]

Number of permit holders: A permit to participate in the squid fishery has been required since April 1998. There are two types of permits. Market squid vessel permits allow a light vessel to attract squid with lights and catch squid. Light boat owner permits only allow the use of attracting lights to aggregate market squid. In the 2002/2003 season there were 184 market squid vessel permits and 40 light boat owner permits issued. Landings of two tons or less are considered incidental and no permit is required.

Number of active permit holders: The number of active permits varies by year depending on market conditions and squid availability. During the 2002/2003 season, there were approximately 105 vessels active during some portion of the year. Thirty-four vessels harvested 90% of the total landings greater than two tons. The 1999/2000 season had the highest squid landings to date, with 132 vessels making squid landings greater than two tons.

Total effort: Beginning in May 2000, logbooks were required for the squid fishery. Results for the 2001 calendar year indicate that each hour of fishing required 5.5 hours of search time by light boats. Combined searching and fishing effort resulted in 3.7 mt of catch per hour. In the 2002/2003 season, the fishery made 2,244 landings. This is a 34.0% decrease from the previous season. In addition, the average landing decreased from 28.2 mt to 19.0 mt.

Geographic range: Since the mid-1980s, the majority of the squid fishing harvest has occurred south of Point Conception. However, during the 2002/2003 season, a moderate El Nino condition resulted in nearly 60% of the catch landed in northern California. The northern fishery harvest ranged from Morro Bay to Fort Bragg, although the majority of fishing occurred within a half mile of the Monterey Bay shoreline. The Monterey Bay fishery has been in operation since the mid-1800s and has historical significance for California. Squid catch south of Point Conception accounted for only 41% of the 2002/2003 landings and declined 54% from 84,024 mt in the previous season to 17,387 mt.

Seasons: This fishery occurs year-round, however, effort in this fishery differs north and south of Point Conception. Typically, the fishery north of Point Conception operates from April through September while the southern fishery is most active from October through March. El Niño conditions hamper the fishery and squid landings are minimal during these events, while landings in the northern fishery often increase. The La Niña event in 1999 resulted in the southern fishery landing squid year-round.

Gear type: There are several gears employed in this fishery. From 1997-2001, the vast majority (98%) of vessels uses either purse (77%) or drum (21%) seine nets. Other types of nets used include lampara, dip and brail nets which are used by a few vessels in southern California. Another gear type associated with the market squid fishery is attracting lights that are used to aggregate spawning squid. In 2000, attracting lights were regulated and each vessel is now restricted to no more than 30,000 watts of lights during fishing activities. Further, to reduce light scatter, lights must be shielded and oriented directly downward. The lighting restrictions were enacted to avoid risks to nesting brown pelicans and interactions with other seabird species of concern.

Regulations: All vessels participating in the squid fishery must have a permit. Commercial squid fishing is prohibited between noon on Friday and noon on Sunday of each week to allow a two-day consecutive uninterrupted period of spawning. A mandatory logbook program for fishing and lighting vessels has been in place since May 2000. In May 2001, a seasonal harvest guideline of 125,000 short tons for market squid was established to limit further expansion of the fishery.

Management type: This fishery was largely unregulated until 1998 when it came under more strict regulatory control by the Department of Fish and Game. The fishery is considered a monitored fishery in the Pacific Fishery Management Council's Coastal Pelagic Species Fishery Management Plan. A state fishery management plan is to be adopted by the Fish and Game Commission by December 2004. The plan considers seasonal and daily catch limitations; weekend closures, research and monitoring programs, harvest replenishment areas, live bait and

[4]This fishery description was provided by Dale Sweetnam, Senior Biologist at CDFG La Jolla.

incidental market squid catch, restricted access programs including transferability, gear restrictions, area and time closures to address seabird issues, and permit fees.

Comments: The squid fishery operates primarily at night and targets spawning aggregations with the use of lights. Encounters between the fishery and pilot whales, pinnipeds, and birds have been documented. Seal bombs are used regularly. Lethal and nonlethal interaction rates are unknown. During the 1980s, California's squid fishery grew rapidly in fleet size and landings when international demand for squid increased due to declining squid fisheries in other parts of the world. In 1997, the rapid growth of fleet size was halted by a moratorium on new permits. Landing records were set several times during the 1990s, but have been curtailed with the establishment of the 125,000 short ton seasonal harvest guideline.

Category III, WA Willapa Bay salmon drift gillnet fishery.
Number of permit holders: The total number of permit holders for this fishery in 1995 and 1996 was 300 but this number has declined in subsequent years. In 1997 there were 264 total permits and 243 in 1998. The NMFS 2001 List of Fisheries lists an estimate of 82 vessels/persons in this fishery.

Number of active permit holders: The number of active permit holders is assumed to be equal to or less than the number of permits eligible to fish in a given year. The number of permits renewed and eligible to fish in 1996 was 300 but declined to 224 in 1997 and 196 permits were renewed for 1998. The 1996-98 counts do not include permits held on waivers for those years, but do include permits that were eligible to fish at some point during the year and subsequently entered into a buyback program. The number of permits issued for this fishery has been reduced through a combination of State and federal permit buyback programs. Vessels permitted to fish in the Willapa Bay are also permitted to fish in the lower Columbia River drift gillnet fishery.

Total effort: Effort in this fishery is regulated through area and species openings. The fishery was observed in 1992 and 1993 when fishery opening were greater than in recent years. In 1992 and 1993 there were 42 and 19 days of open fishing time during the summer "dip-in" fishery. The "dip-in" fishery was closed in 1994 through 1999. Available openings have also declined in the fall chinook/coho fisheries. In 1992/93 respectively there were 44 and 78 days of available fishing time. There were 43, 45, 22 and 16.5 available open fishing days during 1995 through 1998.

Geographic range: This fishery includes all inland marine waters of Willapa Bay. The waters of the Bay are further divided into smaller statistical catch areas.

Seasons: Seasonal openings coincide with local salmon run timing and fish abundance.

Gear type: Fishing gear used in this fishery is a drift gillnet of single web construction, not exceeding 250 fathoms in length, with a minimum stretched mesh size ranging upward from 5 inches depending on target salmon species. The gear is commonly set during periods of low and high slack tides. It is the intention of the fisher to keep the net off the bottom. The vessel is attached to one end of the net and drifts with the net. The entire net is periodically retrieved onto the vessel and catch is removed. Drift times vary depending on fishing area, tidal condition, and catch.

Regulations: This fishery is a limited entry fishery with seasonal openings and gear restrictions.

Management type: The salmon drift gillnet fishery is managed by the Washington Department of Fish and Wildlife.

Comments: Observers were placed onboard vessels in this fishery to monitor marine mammal interactions in the early 1980s and in 1990-93. Five incidentally taken harbor seals were recovered by observers in the fishery from 1991through 1993 (3 in '92 and 2 in '93). Two incidentally taken northern elephant seals were recovered by observers from the fishery in 1991 but no takes of this species were observed. The summer fishery (July- August) in Willapa Bay has been closed since it was last observed in 1993 and available fishing time declined from 1996 through 1998.

Category III, WA Grays Harbor salmon drift gillnet fishery.

Number of permit holders: This commercial drift gillnet fishery does not include Treaty Indian salmon gillnet fishing. The total number of permit holders for this commercial fishery in 1995 and 1996 was 117 but this number has declined in subsequent years. In 1997 there were 101 total permits and 87 in 1998.

Number of active permit holders: The NMFS 2001 List of Fisheries lists a total of 24 vessels/persons operating in this fishery. The number of active permit holders is assumed to be equal to or less than the number of permits eligible to fish in a given year. The number of permits renewed and eligible to fish in 1996 was 117 but declined to 79 in 1997 and 59 permits were renewed for 1998. The 1996-98 counts do not include permits held on waivers for those years but do include permits that were eligible to fish at some point during the year and subsequently entered a buyback program. The number of permits issued for this fishery has been reduced through a combination of State and federal permit buyback programs. Vessels permitted to fish in Grays Harbor are also permitted to fish in the lower Columbia River salmon drift gillnet fishery.

Total effort: Effort in this fishery is regulated through area and species openings. The fishery was observed in 1992 and 1993 when fishery openings were greater than in recent years. In 1992 and 1993 there were 42 and 19 days of open fishing time during the summer "dip-in" fishery. The "dip-in" fishery was closed in 1994 through 1999. Available openings have also declined in the fall chinook/coho fisheries. There were 11, 17.5, 9 and 5 available open fishing days during the 1995 through 1998 fall season.

Geographic range: Effort in this fishery includes all marine waters of Grays Harbor. The waters are further divided into smaller statistical catch areas.

Seasons: This fishery is subject to seasonal openings which coincide with local salmon run timing and fish abundance.

Gear type: Fishing gear used in this fishery is a drift gillnet of single web construction, not exceeding 250 fathoms in length, with a minimum stretched mesh size ranging of 5 inches depending on target salmon species. The gear is commonly set during periods of low and high slack tides and retrieved periodically by the tending vessel. It is the intention of the fisher to keep the net off the bottom. The vessel is attached to one end of the net and drifts with the net. The entire net is periodically retrieved onto the vessel and catch is removed. Drift times vary depending on fishing area, tidal condition, and catch.

Regulations: The fishery is a limited entry fishery with seasonal openings and gear restrictions.

Management type: The salmon drift gillnet fishery is managed by the Washington Department of Fish and Wildlife.

Comments: Observers were placed onboard vessels in this fishery to monitor marine mammal interactions in the early 1980s and in 1990-93. Incidental take of harbor seals was observed during the fishery in 1992 and 1993. In 1992, one harbor seal was observed entangled dead during the summer fishery and one additional seal was observed entangled during the fall fishery but it escaped uninjured. In 1993, one harbor seal was observed entangled dead and one additional seal was recovered by observers during the summer fishery. The summer fishery (July-August) in Grays Harbor has been closed since it was last observed in 1993. Available fishing time in the fall chinook fisheries declined from 1996 through 1998.

Category III, WA, OR lower Columbia River salmon drift gillnet fishery.

Number of permit holders: The total number of permit holders was 856 (344 from Oregon and 512 from Washington) when the fishery was last observed in 1993. In 1995 through 1998 the number of permits was 747, 693, 675 and 620 respectively. The number of permits issued for this fishery by Washington has been reduced through a combination of State and federal buy-back programs. This reduction is reflected in the overall decline in the total number of permits.

Number of active permit holders: The number of active permits is a subset of the total permits issued for the fishery. For example, in 1995, 110 vessels (of the 747 vessels holding permits) landed fish in the mainstem fishery.

Total effort: Effort in this fishery is regulated through species related seasonal openings and gear restrictions. The fishery was observed in 1991, 1992 and 1993 during several seasons of the year. The winter seasons (openings) for 1991 through 1993 totaled 13, 9.5, and 6 days respectively. The winter season has subsequently been reduced to remnant levels to protect upriver ESA listed salmon stocks. In 1995 there was no winter salmon season, in 1996 the fishery was open for 1 day. In 1997 and 1998 the season was shifted to earlier in the year and gear restrictions were imposed to target primarily sturgeon. The fall fishery in the mainstem was also observed 1992 and 1993 as was the Young's Bay terminal fishery in 1993, however, no marine mammal mortalities were observed during these fisheries. The fall mainstem fishery openings varied from 1 day in 1995 to just under 19.5 days in 1997 and 6 days in 1998. The fall Youngs Bay terminal fishery fluctuated between 60 and 70 days for the 1995 through 1998 period which was similar to the fishery during the period observed.

Geographic range: This fishery occurs in the main stem of the Columbia river from the mouth at the Pacific Ocean upstream to river mile 140 near the Bonneville Dam. The lower Columbia is further subdivided into smaller statistical catch areas which can be regulated independently.

Seasons: This fishery is subject to season and statistical area openings which are designed to coincide with run timing of harvestable salmon runs while protecting weak salmon stocks and those listed under the Endangered Species Act. In recent years, early spring (winter) fisheries have been sharply curtailed for the protection of listed salmon species. In 1994, for example, the spring fishery was open for only three days with approximately 1900 fish landed. In 1995 the spring fishery was closed and in 1996 the fishery was open for one day but fishing effort was minimal owing to severe flooding. Only 100 fish were landed during the one day in 1996.

Gear type: Typical gear used in this fishery is a gillnet of single web construction, not exceeding 250 fathoms in length, with a minimum stretched mesh size ranging upwards from 5 inches depending on target salmon species. The gear is commonly set during periods of low and high slack tides. It is the intention of the fisher to keep the net off the bottom. The vessel is attached to one end of the net and drifts with the net. The entire net is periodically retrieved onto the vessel and catch is removed. Drift times vary depending on fishing area, tidal condition, and catch.

Regulations: The fishery is a limited entry fishery with seasonal openings, area closures, and gear restrictions.

Management type: The lower Columbia River salmon drift gillnet fishery is managed jointly by the Washington Department of Fish and Wildlife and the Oregon Department of Fish and Wildlife.

Comments: Observers were placed onboard vessels in this fishery to monitor marine mammal interactions in the early 1980s and in 1990-93. Incidental takes of harbor seal and California sea lion were documented, but only during the winter seasons (which have been reduced dramatically in recent years to protect ESA listed salmon) . No mortalities were observed during the fall fisheries.

Category III, WA, OR salmon net pens.

Number of permit holders: There were 12 commercial salmon net pen ("grow out") facilities licensed in Washington in 1998. There are no commercial salmon net pen or aquaculture facilities currently licensed in Oregon. Non-commercial salmon enhancement pens are not included in the list of commercial fisheries.

Number of active permit holders: Twelve salmon net pen facilities in Washington.

Total effort: The 12 licensed facilities on Washington operate year-round.

Geographic range: In Washington, net pens are found in protected waters in the Straits (Port Angeles), northern Puget Sound (in the San Juan Island area) as well as in Puget Sound south of Admirality Inlet. There are currently no commercial salmon pens in Oregon.

Seasons: Salmon net pens operate year-round.

Gear type: Net pens are large net impoundments suspended below a floating dock-like structure. The floating docks are anchored to the bottom and may also support guard (predator) net systems. Multiple pens are commonly rafted together and the entire facility is positioned in an area with adequate tidal flow to maintain water quality.

Regulations: Specific regulations unknown.

Management type: In Washington, the salmon net pen fishery is managed by the Washington Department of Natural Resources through Aquatic Lands Permits as well as the Washington Department of Fish and Wildlife.

Comments: Salmon net pen operations have not been monitored by NMFS for marine mammal interactions, however, incidental takes of California sea lions and harbor seals have been reported.

Category III, WA, OR, CA groundfish trawl.

Approximate number of vessels/persons: In 1998, approximately 332 vessels used bottom and mid-water trawl gear to harvest Pacific coast groundfish. This is down from 383 vessels in 1995. The NMFS List of Fisheries for 2001 lists 585 vessels as participating in this fishery. Groundfish trawl vessels harvest a variety of species including Pacific whiting (hake), flatfish, sablefish, lingcod, and rockfish. This commercial fishery does not include Treaty Indian fishing for groundfish.

All observed incidental marine mammal takes have occurred in the mid-water trawl fishery for Pacific whiting. The annual whiting allocation is divided between vessels that harvest and process catch at sea and those that harvest and deliver catch to shore-based processing facilities. At least one NMFS-trained observer is placed on board each at-sea processing vessel to provide comprehensive data on total catch, including marine mammal takes. In the California, Oregon, and Washington range of the fishery, the number of vessels fishing ranged between 12 and 16 (all with observers) during 1997-2001. Whiting vessels that deliver to shore-based processors are issued Exempted Fishing Permits that requires the entire catch to be delivered unsorted to processing facilities where State technicians have the opportunity to sample. In 1998, 13% of the whiting deliveries landed at shore-based processors were monitored. The following is a description of the commercial whiting fishery.

Number of permit holders/active permit holders: A license limitation ("limited entry") program has been in effect in the Pacific coast groundfish fishery since 1994. Non-tribal trawl vessels that harvest groundfish are required to possess a limited entry permit to operate in the fishery. Any vessel with a federal limited entry trawl permit may fish for whiting, but the number of vessels that do is smaller than the number of permits. In 1998, approximately 61 limited entry vessels, 7 catcher/processors and 50 catcher vessels delivering to shoreside and mothership processors, made commercial landings of whiting during the regular season. In addition, 6 unpermitted mothership processors received unsorted whiting catch.

Total effort: The whiting allocation continues to be fully utilized. From 1997 to 1999 the annual allocation was 232,000 mt/year, this is an increase over the 1996 allocation of 212,000 mt and the 1995 allocation of 178,400 mt. In 1998, motherships vessels received 50,087 mt of whiting in 17 days, catcher/processors took 70,365 mt of whiting in 54 days and shore-based processors received 87,862 mt of whiting over a 196 day period.

Geographic range: The fishery extends from northern California (about 40^{o} 30' N. latitude) to the U.S.-Canada border. Pacific whiting migrate from south to north during the fishing season, so effort in the south usually occurs earlier than in the north.

Seasons: From 1997 to 1999, season start dates have remained unchanged. The shore-based season in most of the Eureka area (between 42^{O}- $40^{O}30'$ N latitude) began on April 1, the fishery south of $40^{O}30'$ N latitude opened April 15, and the fishery north of 42^{O} N latitude started on June 15. In 1998, the primary season for the shore-based fleet closed on October 13, 1998. The primary seasons for the mothership and catcher/processor sectors began May 15, north of 42^{0} N. lat. In 1998, the mothership fishery closed on May 31, the catcher/processor fishery closed on August 7.

Gear type: The Pacific whiting trawl fishery is conducted with mid-water trawl gear with a minimum mesh size of 3 inches throughout the net.

Regulations/Management type: This fishery is managed through federal regulations by the Pacific Fishery Management Council under the Groundfish Fishery Management Plan.

Comments: Since 1991, incidental takes of Steller sea lions, Pacific white-sided dolphin, Dall's porpoise, California sea lion, harbor seal, northern fur seal, and northern elephant seal have been documented in the whiting fishery. From 1997-2001, 4 California sea lions, 2 harbor seals, 2 northern elephant seals, 1 Pacific white-sided dolphin, and 6 Dall's porpoise were reported taken in California/Oregon/Washington regions by this fishery.

Category III, Hawaii gillnet fishery.[5]

Number of active permit holders: In 1997 there were 129 active commercial fishers. In 1995 there were approximately 115.

Total effort: In 1997 there were 2,109 trips for a total catch of 864,194 pounds with 792,210 pounds sold. This fishery operates in nearshore and coastal pelagic regions.

Seasons: This fishery operates year-round with the exception of Juvenile big-eyed scad less than 8.5 inches which cannot be taken from July through October.

Gear type: Gillnets of stretched mesh greater than 2 inches and stretched mesh size greater than 2.75 inches for stationary gillnets. Stationary nets must be inspected every 2 hours and total soak time cannot exceed four hours in the same location. New restrictions implemented in 2002 include that nets may not: 1) be used more than once in a 24-hour period; 2) exceed a 12 ft stretched height limit; 3) exceed a single-panel; 4) be used at night; 5) be set within 100 ft. of another lay net; 6) be set in more than 80 ft depths; 7) be left unattended for more than ½ hour; 8) break coral during retrieval and nets must be 1) registered with the Division of Aquatic Resources; 2) inspected within two hours after being set; 2) tagged with two marker buoys while fished. In addition to these gear restrictions, non-commercial users of lay nets may not use a net longer than 500 ft, while commercial users may use nets up to 1200 ft in length. Additional mesh restrictions are in place for taking the big-eyed scad.

Regulations: Gear and season restrictions (see above).

Management type: Managed by the State of Hawaii Division of Aquatic Resources.

Comments: The principle catches include reef fishes and big-eyed scad (akule) and mackerel scad (opelu). Interactions have been documented with bottlenose dolphin and spinner dolphin.

[5]Descriptions of Hawaii State managed fisheries provided by William Devick, State of Hawaii, Department of Land and Natural Resources, Division of Aquatic Resources, Honolulu Hawaii.

Category III, Hawaii lobster trap fishery.[6] [7]
Note: The portion of this fishery managed by the State of Hawaii and operating in the MHI is about 1% of the size (total pounds of lobster caught) of the federally managed fishery operating primarily in the NWHI. The description that follows refers to the NWHI fishery unless stated otherwise.

Number of permit holders: There are 15 permit holders under a (1991) federal limited access program.

Number of active permit holders: In 1998 and 1999 there were 5 and 6 vessels that participated respectively. In the MHI there were 5 active fishers in 1997.

Total effort: The number of trap hauls for 1999 is not available at this time. However, the majority of the effort took place in the 4 harvest guideline areas; Necker Bank, Gardner Pinnacles and Maro Reef, with the remaining effort spread out over 10 unique areas. In 1998 171,000 trap hauls were made by the 5 vessels during 9 trips and in 1997 a total of 177,700 hauls were made. In the MHI 19 trips were made in 1997.

Geographic range: Lobster permits allow fishing operations in the US EEZ from 3 to 200 nmi offshore American Samoa, Guam and Hawaii (including the EEZ areas of the NWHI and MHI). However, no vessels have operated in the EEZ's of American Samoa or Guam since 1983.

Seasons: This fishery operates under a seasonal harvest guideline system opening on July 1. The season ends once the harvest guideline is met, but no later than December 31. In 1998, the harvest guideline was divided into the 4 areas mentioned above with total lobster catch set at (in thousands) 70, 20, 80, and 116, respectively. Area closure occurs once an area's harvest guideline is met. In the MHI, open season is from September through April.

Gear type: One string consists of approximately 100 Fathom-plus plastic lobster traps. About 10 such strings are pulled and set each day. Since 1987 escape vents that allow small lobsters to escape from the trap have been mandatory. In 1996, the fishery became "retain all", i.e. there are no size limits or prohibitions on the retention of berried female lobsters. The entry-way of the lobster trap must be less than 6.5 inches to prevent monk seals from getting their heads stuck in the trap. In the MHI, rigid trap materials must have a dimension greater than 1 inch by 2 inches, with the trap not exceeding 10 feet by six feet.

Regulations: Season, gear and quota restrictions (see above) for the NWHI were formulated by the Western Pacific Regional Fishery Management Council and implemented by NMFS. The MHI fishery is managed by the State of Hawaii, Division of Aquatic Resources with season and gear restrictions (see above).

Management type: Limited access program with bank specific quotas and closures. In the MHI, open access.

Comments: The NWHI fishery targets the red spiny lobster and the common slipper lobster. The ridgeback slipper lobster is also taken. Protected species of concern include monk seals (mentioned above) and turtles. There have been no interactions with these species since 1995 but they have been seen in the vicinity of the fishing gear.

Category III, Hawaii inshore handline fishery.

In 1997 a total 750 fishers made 8,526 fishing trips in the main Hawaiian Islands and caught 531,449 pounds and sold 475,562 pounds for an ex-vessel landing value of $1,010,758. This fishery occurs in nearshore and coastal pelagic regions. The principal catches include reef fishes and big-eyed scad (akule) and mackerel scad (opelu). In 1995 approximately 650 fishers were active. Interactions have been documented for bottlenose dolphin.

[6] Kawamoto, K. and Samuel G. Pooley. 1999. Draft Annual report of the 1998 western pacific lobster fishery.
[7] Kawamoto, K. 1999. Summary of the 1999 NWHI Lobster Fishing Season. NMFS Honolulu Laboratory.

Category III, Hawaii deep sea bottomfish handline and jig fishery.
Note: There are two commercial bottomfish fisheries in Hawaii: a distant water Northwestern Hawaiian Islands (NWHI) limited entry fishery under federal jurisdiction and the main Hawaiian Islands bottomfish fishery primarily under the State of Hawaii jurisdiction.

Number of permit holders: The main Hawaiian Islands fishery is open access with close to 2,000 bottomfish vessels registered with the State of Hawaii, whereas the NWHI is restricted to a maximum of 17 vessels.

Number of active permit holders: In 1997 in the MHI a total of 750 fishers were active. The NWHI are divided into the Mau Zone (closer to MHI) and the Hoomalu Zone. The Hoomalu Zone is a limited entry zone with 6 vessels participating in 1998, 7 vessels fished the Mau Zone in the same year. Restrictions on new entry into the Mau Zone were implemented in 1998.

Total effort: In 1998 in the MHI approximately 8,500 trips were made with a total catch of 424,000 pounds for an ex-vessel landing value of $1,336,000. This fishery occurs primarily in offshore banks and pinnacles. In the NWHI 332,000 pounds ($894,000) were caught in 1998, below average since 1990.

Seasons: Year round.
Gear type: This fishery is a hook-and-line fishery that takes place in deep water. In the NWHI fishery, vessels are 30 ft or greater and conduct trips of about 10 days. In the MHI the vessels are smaller than 30 ft and trips last from 1 to 3 days.

Regulations: In the MHI, the sale of snappers (opakapaka, onaga and uku) and jacks less than one pound is prohibited. In June of 1998, Hawaii Division of Aquatic Resources (HDAR) closed 19 areas to bottomfishing and regulations pertaining to seven species (onaga, opakapaka, ehu, kalekale, gindai, hapuupuu and lehi) were enacted.

Management type: The MHI is managed by the HDAR with catch, gear and area restrictions (see above) but no permit limits. The NWHI is a limited access federal program.

Comments: The deep-slope bottomfish fishery in Hawaii concentrates on species of eteline snappers, carangids, and a single species of grouper concentrated at depths of 30-150 fathoms. These fish have been fished on a subsistence basis since ancient times and commercially for at least 90 years. NMFS is considering the possibility of re-categorizing the NWHI bottomfish fishery from Category III to Category II due to concerns for potential interactions between bottomfish fishing vessels and Hawaiian monk seals, although there were none observed during 26 NWHI bottomfish trips during 1990-1993, and none reported. On 12 of the 26 trips, bottlenose dolphins have been observed stealing fish from the lines, but not hookings or entanglements occurred. Effort in this fishery increases significantly around the Christmas season because a target species, a true snapper, is typically sought for cultural festivities.[11] No data is collected for recreational or subsistence fishermen, but their MHI catch is estimated to be about equal to the MHI commercial catch.

Category III, Hawaii tuna handline and jig fishery.

In 1997 a total of 543 fishers made 6,627 trips in the MHI and caught 2,014,656 pounds and sold 1,958,759 pounds for an ex-vessel value of $3,788,391. This fishery occurs around offshore fish aggregating devices and mid-ocean seamounts and pinnacles. The principal catches are small to medium sized bigeye, yellowfin and albacore tuna. There are several types of handline methods in the Hawaiian fisheries. Baited lines with chum are used in day fishing operations (palu-ahi), another version uses squid as bait during night operations (ika-shibi), and an operation called “danglers” uses multiple lines with artificial lures suspended or dangled over the water. Interactions have been documented for rough-toothed dolphin, bottlenose dolphin, and Hawaiian monk seal.

Table 1. The number of animals injured (I) and killed (K) reported to the Marine Mammal Authorization Program (MMAP) compared with data reported from the NMFS Observer Program for two California gillnet fisheries for the years 1998-2002.

	1998				1999				2000				2001				2002			
	MMAP		NMFS		MMAP		NMFS		MMAP		NMFS		MMAP		NMFS		MMAP		NMFS	
Species	I	K	I	K	I	K	I	K	I	K	I	K	I	K	I	K	I	K	I	K
Minke whale	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Sperm whale	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray whale	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Humpback whale	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Short-finned pilot whale	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pacific white-sided dolphin	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	2	0	0	0	1
Common dolphin spp.	2	5	0	9	8	29	0	35	3	15	0	25	1	6	0	7	0	3	1	10
Risso's dolphin	0	0	0	0	0	0	0	0	0	2	0	3	0	0	0	0	0	0	0	0
Northern right whale dolphin	0	0	0	0	0	1	0	3	0	6	0	11	0	1	0	5	0	2	0	2
Dall's porpoise	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unidentified small cetacean	0	0	0	0	0	3	0	0	4	1	0	0	2	2	0	0	0	2	0	0
California sea lion	3	19	0	23	0	5	0	6	0	14	0	13	1	2	0	2	0	7	0	18
Steller's sea lion	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Northern elephant seal	0	0	0	4	2	1	0	2	1	1	0	6	0	0	0	1	0	0	0	1
Harbor seal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unidentified seal	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0
Unidentified baleen whale	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unidentified toothed whale	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Total Occurrences Reported	5	27	0	38	10	41	1	46	9	41	0	60	5	11	0	17	1	15	1	32

Table 2. Strandings reported to the NMFS Marine Mammal Stranding Network 1998-2002. hr = human-related strandings.

Species	1998				1999				2000				2001				2002			
	CA	hr	OR/WA	hr	CA	hr	OR/WA	hr	CA	hr	OR/WA	hr	CA	hr	OR/WA	hr	CA	hr	OR/WA	hr
Harbor Porpoise	37	4	25	0	31	2	7	0	20	2	6	1	12	4	15	1	19	5	0	0
Dall's Porpoise	2	0	2	0	4	0	3	0	3	0	9	1	2	1	6	0	3	0	0	0
Pac. White-sided Dolphin	5	0	1	0	4	1	1	0	3	0	0	0	6	2	0	0	2	0	1	0
Risso's Dolphin	3	0	0	0	2	4	1	0	6	0	1	0	3	0	0	0	4	2	0	0
Bottlenose Dolphin	4	0	0	0	3	0	0	0	12	0	0	0	14	0	0	0	13	0	0	0
Common Dolphin	35	1	0	0	37	0	0	0	30	1	0	0	33	4	0	0	88	4	0	0
Striped Dolphin	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N. Right Whale Dolphin	1	0	0	0	2	0	0	0	0	0	0	0	5	0	0	0	1	0	0	0
Rough-toothed Dolphin	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Killer Whale	0	0	1	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0
Short-finned Pilot Whale	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0
Baird's Beaked Whale	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stejneger's Beaked Whale	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
Cuvier's Beaked Whale	2	0	1	0	0	0	0	0	1	0	0	0	0	0	1	1	3	0	0	0
Peruvian Beaked Whale	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Unident. Beaked Whale	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pygmy Sperm Whale	6	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	3	1	0	0
Dwarf Sperm Whale	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Sperm Whale	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0
Gray Whale	3	3	4	1	47	6	31	2	58	8	25	0	5	1	1	0	7	3	1	1
Minke Whale	1	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0
Blue Whale	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0
Fin Whale	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	4	4
Sei Whale	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Humpback Whale	2	0	2	0	0	0	0	0	4	3	0	0	2	1	0	0	1	0	0	0
Unidentified Cetacean	0	0	0	0	0	0	3	0	1	0	4	1	0	0	0	0	1	0	1	0
Unidentified Porpoise	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unidentified Dolphin	12	0	5	0	13	2	2	0	11	0	2	0	9	0	2	0	30	1	0	0
Unidentified Whale	2	0	0	0	3	1	0	0	1	0	0	0	4	4	0	0	2	2	0	0
Unident. Balaenopterid	0	0	1	0	0	0	1	0	0	0	0	0	2	0	0	0	3	1	0	0
Northern Fur Seal	21	0	1	0	7	1	3	0	3	0	6	0	2	0	1	1	9	0	0	0
Guadalupe Fur Seal	3	0	0	0	5	0	0	0	1	0	0	0	3	1	0	0	1	0	0	0
Steller (Nthn) Sea Lion	10	2	7	0	11	1	3	0	10	2	5	0	9	0	4	0	5	0	3	0
California Sea Lion	2576	199	75	9	596	52	35	3	1268	67	32	5	990	98	27	1	1821	195	8	0
Unidentified Sea Lion	0	0	0	0	0	0	9	1	1	0	8	0	0	0	17	0	1	0	0	0
Harbor Seal	313	21	121	7	135	7	176	4	230	13	148	8	152	8	170	8	160	18	121	6
Northern Elephant Seal	409	6	24	0	200	1	2	0	211	3	11	0	216	4	11	0	174	7	0	0
Unidentified Seal	0	0	5	0	0	0	26	1	0	0	17	1	0	0	11	1	1	0	0	0
Unidentified Pinniped	236	0	88	0	112	0	13	0	133	0	8	0	110	0	9	0	195	0	4	0
Totals for Cetaceans	120	9	43	1	154	16	50	2	152	14	48	3	101	18	28	2	183	20	10	5
Totals for Pinnipeds	3568	228	321	16	1066	62	267	9	1857	85	235	14	1482	111	250	11	2367	220	136	6

1998-2002 human-related fraction (Cetaceans) 0.10
1998-2002 human-related fraction (Pinnipeds) 0.07

Table 3. Characteristics of Category I and Category II gillnet fisheries in California.

Fishery	Species	Mesh Size	Water Depth	Set Duration	Deployment	Miscellaneous
Category II CA/OR thresher shark/swordfish drift gillnet fishery	swordfish/shark	14 to 22 inches	Ranges from 90 to 4600 meters	Typically 8 to 15 hrs	Drift net only	Nets 500 to 1800 meters in length; other species caught: opah, louver, tuna, thresher, blue shark, mako shark
Category I CA angel shark/halibut and other species set gillnet fishery (>3.5 inch mesh)	Halibut/angel shark	8.5 inch	< 70 meters	24 hrs	Set net	
	Barracuda	3.5 inch		< 12 hrs	Drift net	April – July
	Leopard Shark	7.0 to 9.0 inch	< 90 meters			Fished similar to halibut.
	Perch/Croaker	3.5 to 4.0 inch	< 40 meters	< 24 hrs	Set net	Few boats target these species
	Rockfish	4.5 to 7.5 inch	> 90 meters	12 to 18 hrs	Set net	Net lengths 450 to 1800 meters. Soupfin shark is major bycatch.
	Soupfin shark	6.0 to 8.5 inch	> 50 meters	24 hrs	Set net	Few boats target this species.
	Miscellaneous shark	6.0 to 14 inch	< 70 meters	8 to 24 hrs	Drift, some set net	Species include thresher and swell sharks.
Category II CA Yellowtail, barracuda, white seabass, and tuna drift gillnet fishery	White seabass, yellowtail, barracuda, white seabass, and tuna	Typically 6.5 inch	15 to 90 meters	8 to 24 hrs	Mostly drift net	White seabass predominant target species.

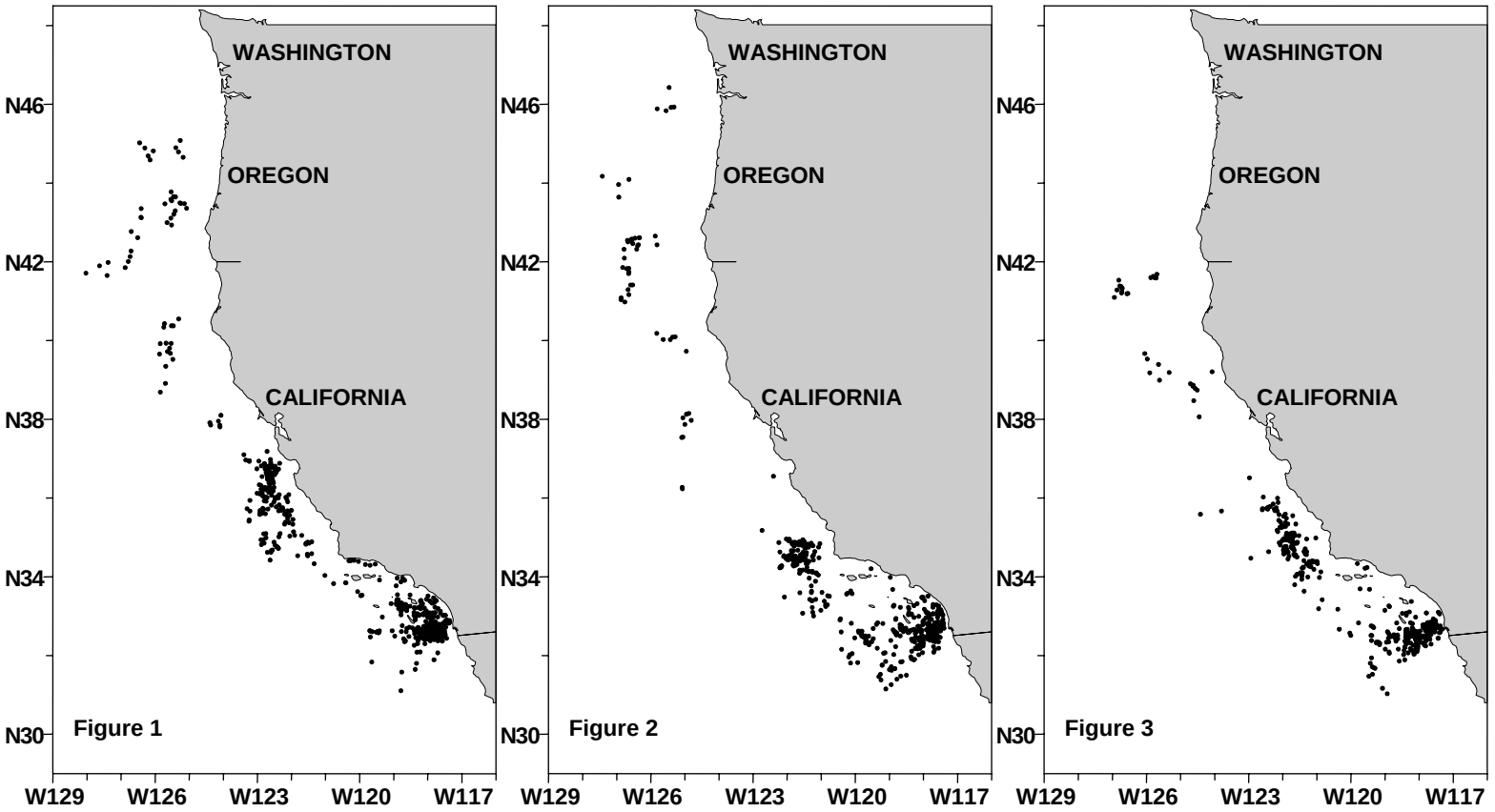
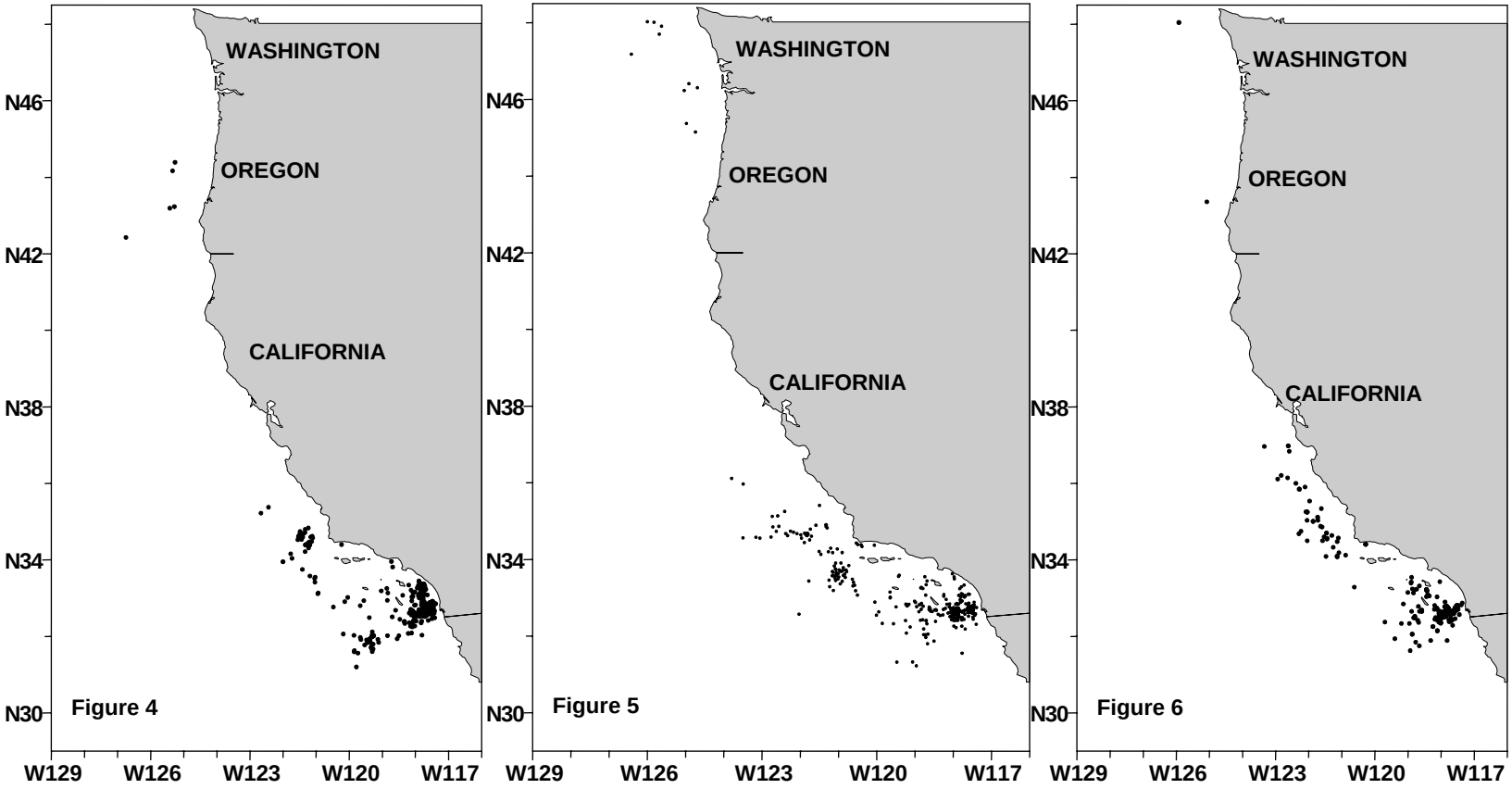


Figure 1 – 3. Locations of 587, 526, and 444 observed sets in the swordfish/thresher shark drift gillnet fishery in 1998, 1999, and 2000, respectively. An estimated 3353, 2634, and 1936 sets were fished in 1998, 1999, and 2000, respectively.



Figures 4-6. Locations of 339 and 360 observed sets in the swordfish/thresher shark drift gillnet fishery in 2001 and 2002, respectively. Figure 6 shows the locations of 199 observed marine mammal entanglements resulting in injury or death over the period 1998-2002. There were approximately 11,000 sets fished during this period.

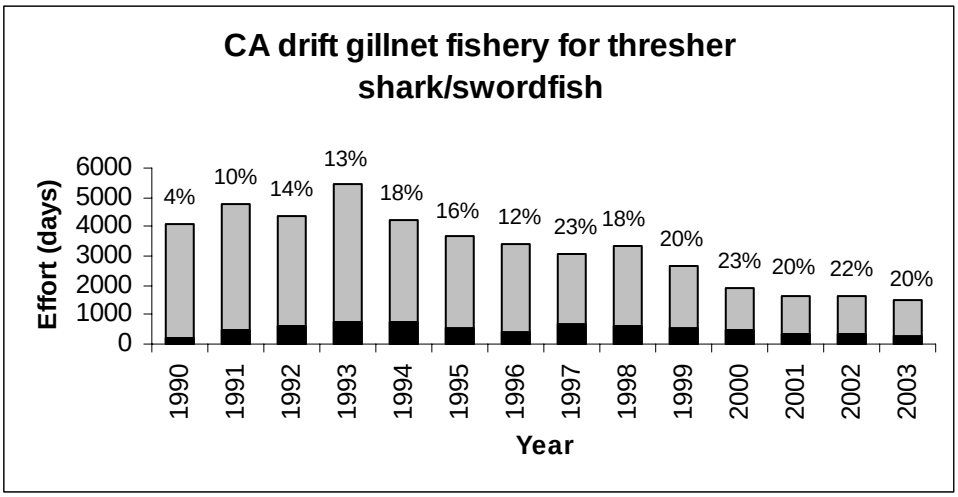


Figure 7. Estimated (gray) and observed (black) days of fishing effort for 1990-2003 in the California/Oregon thresher shark/swordfish drift gillnet fishery (≥ 14 inch mesh). Percent observer coverage for each year is shown above the bars.

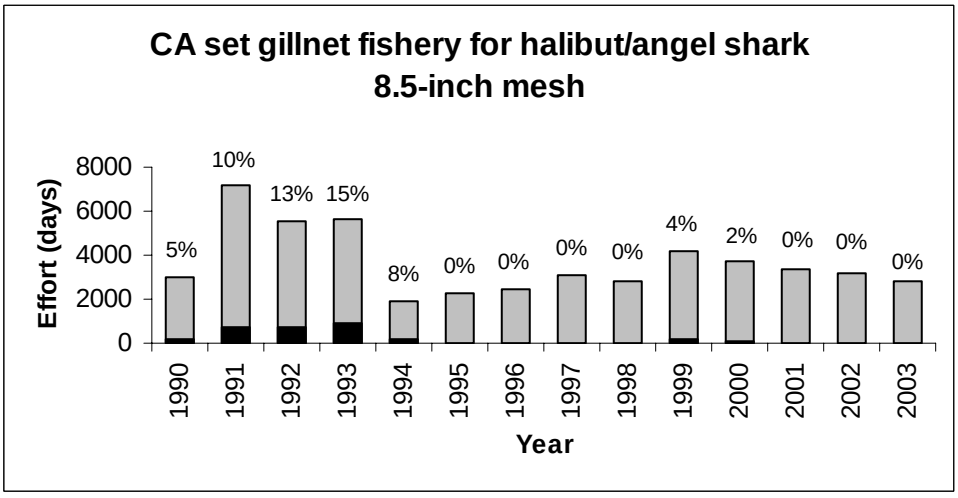


Figure 8. Estimated (gray) and observed (black) days of fishing effort for 1990-2003 in the California angel shark/halibut set gillnet fishery (> 3.5 inch mesh). The fishery was observed only from 1990-94 and again in 1999 and 2000. Percent observer coverage for each year is shown above the bars.

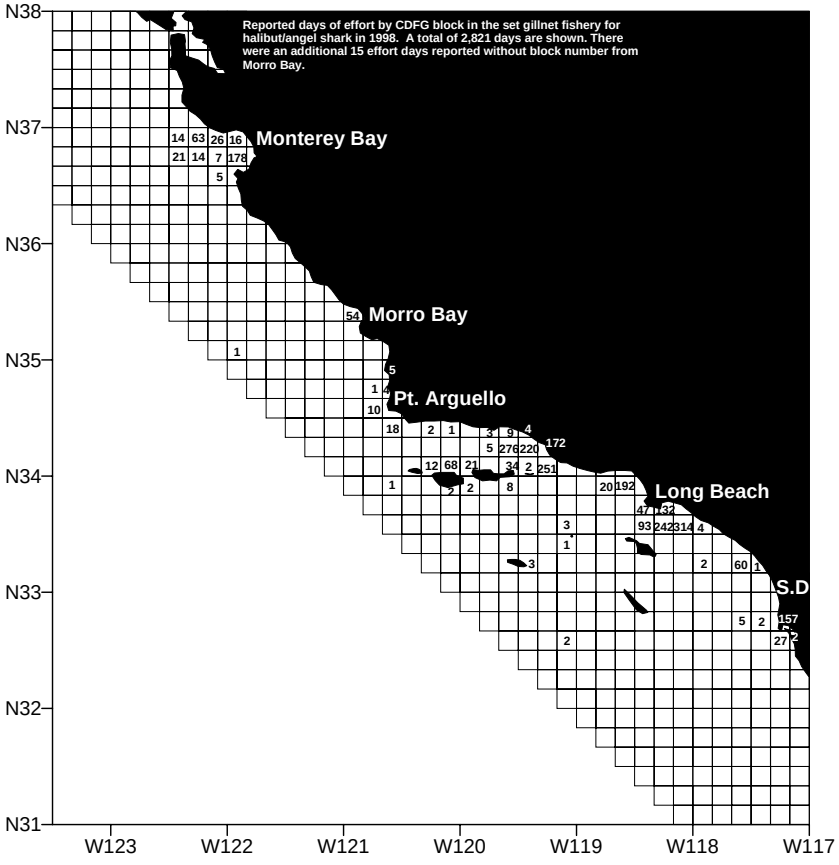


Figure 9. Reported fishing effort in days in the halibut/angel shark set gillnet fishery for 1998.

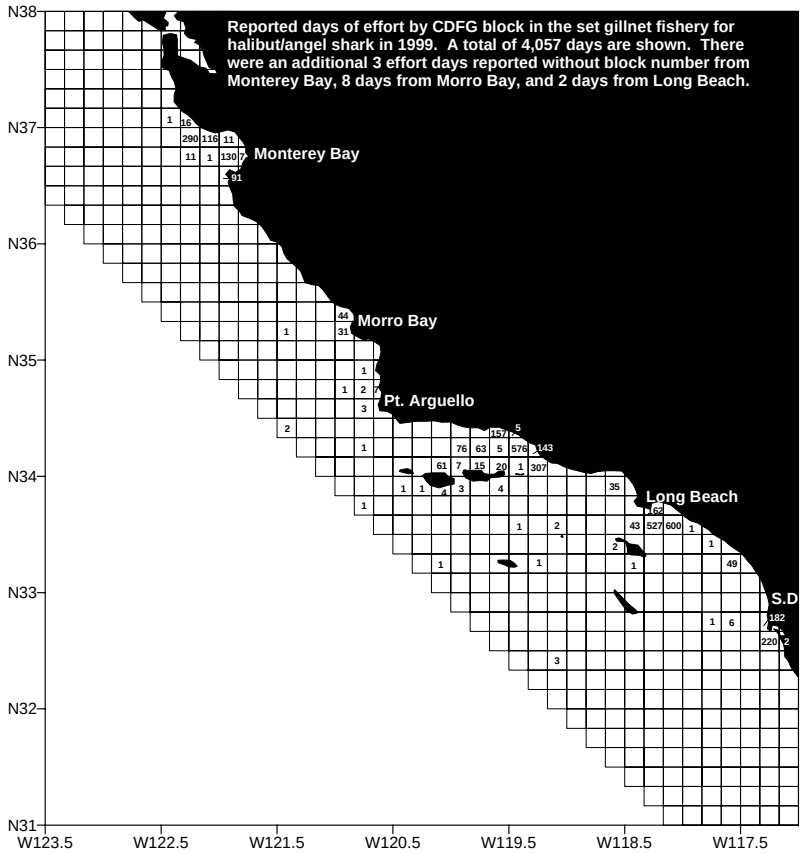


Figure 10. Reported fishing effort in days in the halibut/angel shark set gillnet fishery for 1999.

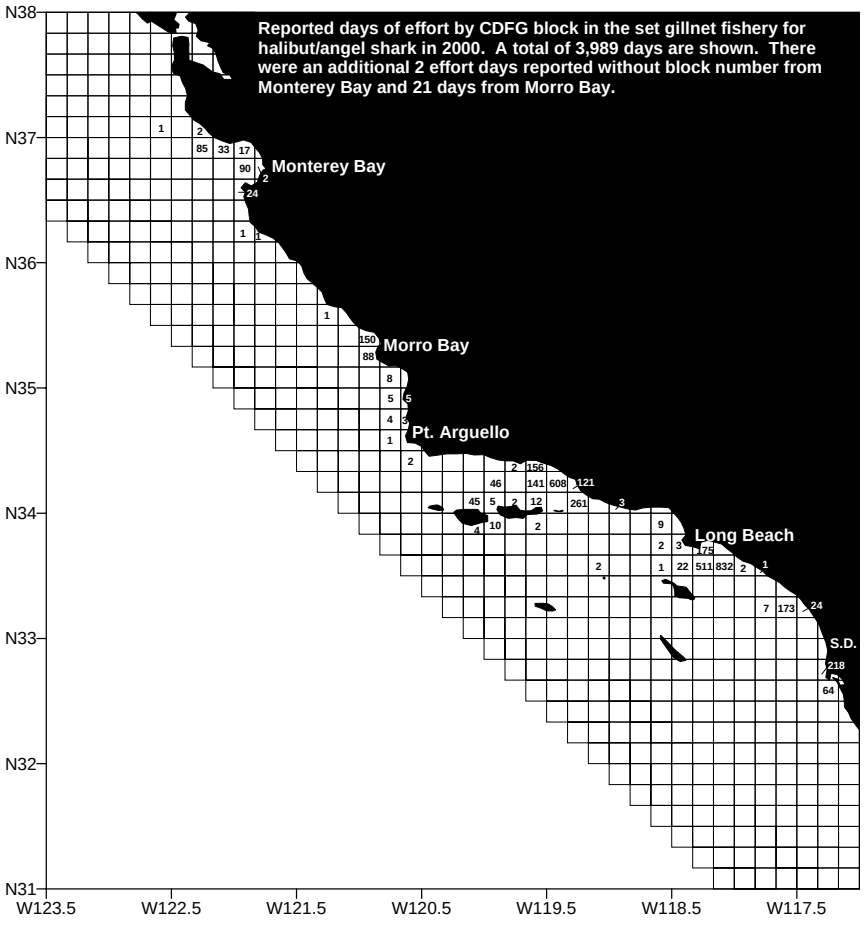


Figure 11. Reported fishing effort in days in the halibut/angel shark set gillnet fishery for 2000.

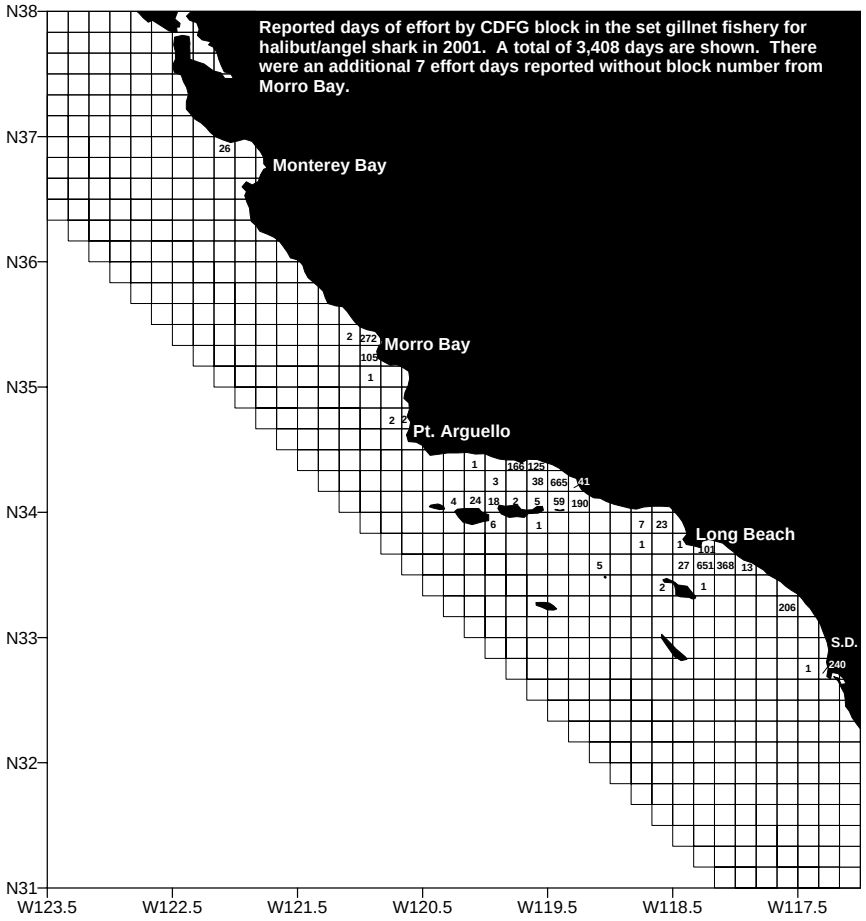


Figure 12. Reported fishing effort in days in the halibut/angel shark set gillnet fishery for 2001.

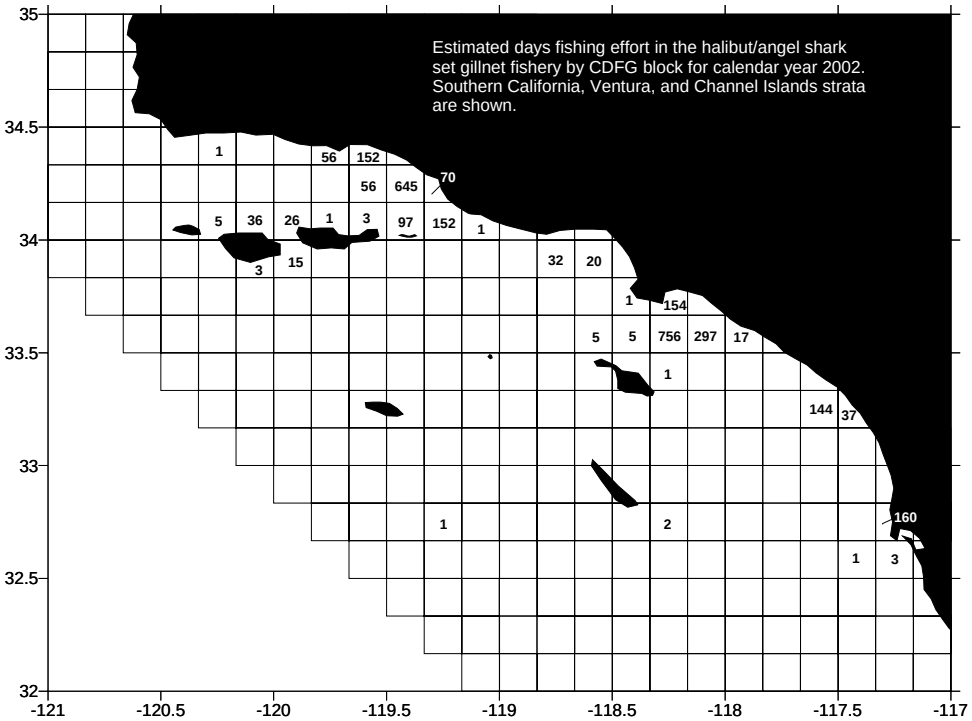


Figure 13. Reported fishing effort in days in the halibut/angel shark set gillnet fishery for 2002 (southern California).

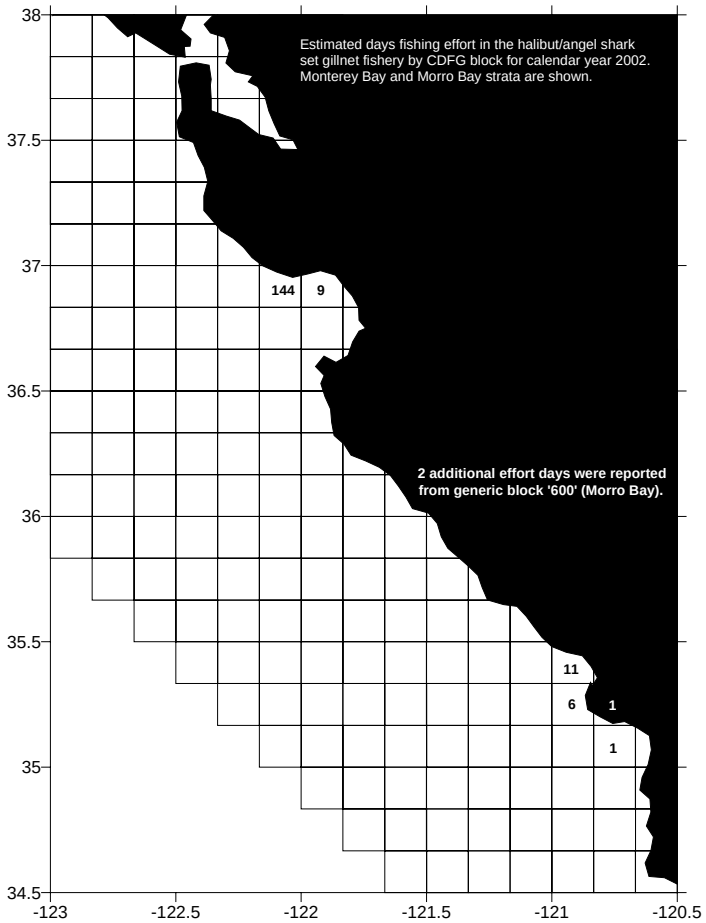


Figure 14. Reported fishing effort in days in the halibut/angel shark set gillnet fishery for 2002 (central California).

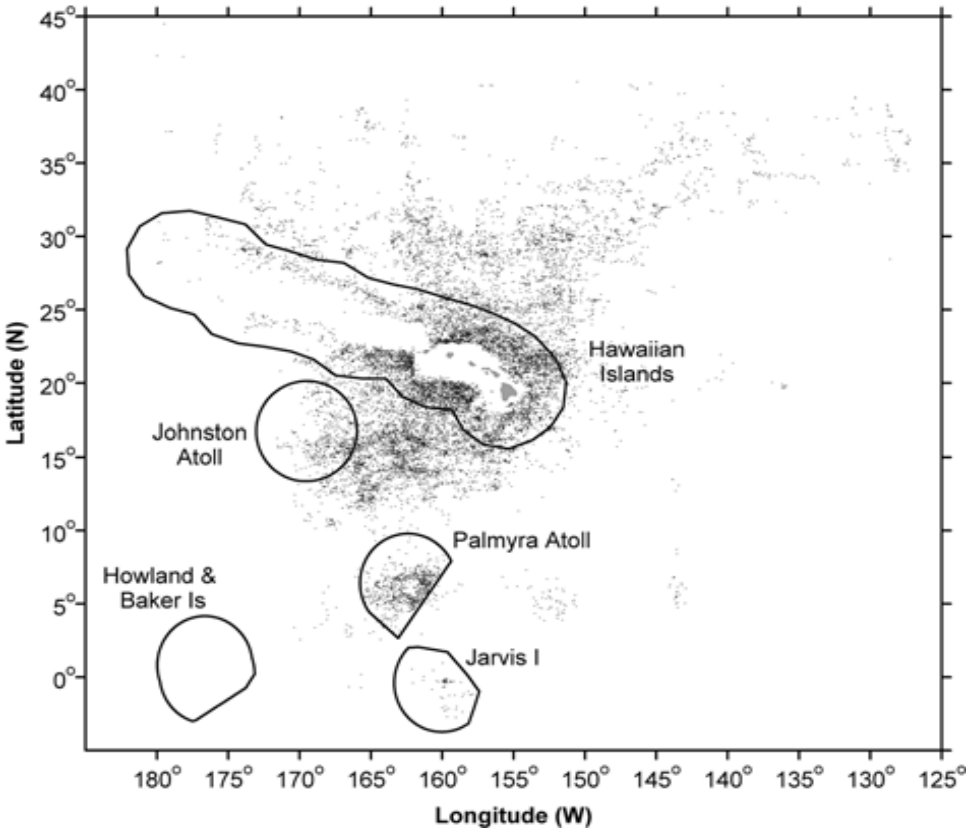


Figure 15. Observed set locations in the Hawaii-based longline fishery, 1994-2002.

Information for stocks which were revised in 2005 appears shaded.

SUMMARY OF 2004 PACIFIC MARINE MAMMAL STOCK ASSESSMENT REPORTS

Species	Stock Area	Region	NMFS Center	N_{min}	R_{max}	F_r	PBR	Total Annual Mortality + Serious Injury	Annual Fishery Mortality + Serious Injury	Strategic Status
California sea lion	U.S.	PAC	SWC	138,881	0.12	1.0	8,333	1,562	1,476	N
Harbor seal	California	PAC	SWC	~~25,720~~31,600	0.12	1.0	~~1,543~~1,896	~~$433~~≥ 389	~~433~~389	N
Harbor seal	Oregon/Washington Coast	PAC	AKC	22,380	0.12	1.0	1,343	≥17	≥15	N
Harbor seal	Washington Inland Waters	PAC	AKC	12,844	0.12	1.0	771	≥34	≥30	N
Northern Elephant Seal	California breeding	PAC	SWC	60,547	0.083	1.0	2,513	≥88	≥86	N
Guadalupe Fur Seal	Mexico to California	PAC	SWC	3,028	0.12	0.5	91	0	0	Y
Northern Fur Seal	San Miguel Island	PAC	AKC	4,190	0.086	1.0	180	0.8	≥0.6	N
Monk Seal	Hawaii	PAC	PIC	~~1,378~~1,224	0.07	0.1	n/a	n/a	n/a	Y
Harbor porpoise	Morro Bay	PAC	SWC	1,206	0.04	0.4	10	4.5	4.5	N
Harbor porpoise	Monterey Bay	PAC	SWC	1,149	0.04	0.45	10	9.5	9.5	N
Harbor porpoise	San Francisco – Russian River	PAC	SWC	6,254	0.04	0.5	63	≥ 0.8	≥ 0.8	N
Harbor porpoise	Northern CA/Southern OR	PAC	SWC	12,940	0.04	1.0	259	≥ 0	≥ 0	N
Harbor porpoise	Oregon/Washington Coast	PAC	AKC	28,967	0.04	0.5	290	3.2	3.2	N
Harbor porpoise	Washington Inland Waters	PAC	AKC	2,545	0.04	0.4	20	15.2	15.2	N
Dall's porpoise	California/Oregon/Washington	PAC	SWC	75,915	0.04	0.48	729	7	7	N
Pacific white-sided dolphin	California/Oregon/Washington	PAC	SWC	39,822	0.04	0.48	382	≥ 5.4	≥ 5.4	N
Risso's dolphin	California/Oregon/Washington	PAC	SWC	12,748	0.04	0.4	115	3.6	3.6	N
Bottlenose dolphin	California Coastal	PAC	SWC	186	0.04	0.5	1.9	0	0	N
Bottlenose dolphin	California/Oregon/Washington Offshore	PAC	SWC	3,053	0.04	0.5	31	0	0	N
Striped dolphin	California/Oregon/Washington	PAC	SWC	9,165	0.04	0.5	92	0	0	N

Information for stocks which were revised in 2005 appears shaded.

SUMMARY OF 2004 PACIFIC MARINE MAMMAL STOCK ASSESSMENT REPORTS

Species	Stock Area	Region	NMFS Center	N_{min}	R_{max}	F_r	PBR	Total Annual Mortality + Serious Injury	Annual Fishery Mortality + Serious Injury	Strategic Status
Common dolphin, short-beaked	California/Oregon/Washington	PAC	SWC	365,617	0.04	0.5	3,656	93	93	N
Common dolphin, long-beaked	California/Oregon/Washington	PAC	SWC	25,163	0.04	0.48	242	11	11	N
Northern right whale dolphin	California/Oregon/Washington	PAC	SWC	16,417	0.04	0.5	164	23	23	N
Killer whale	Eastern North Pacific Offshore	PAC	SWC	361	0.04	0.5	3.6	0	0	N
Killer whale	Eastern North Pacific Southern Resident	PAC	AKC	~~83~~84	0.04	0.5	0.8	0	0	Y
Short-finned pilot whale	California/Oregon/Washington	PAC	SWC	149	0.04	0.4	~~1.19~~1.2	1.0	1.0	~~Y~~N
Baird's beaked whale	California/Oregon/Washington	PAC	SWC	152	0.04	0.5	1.5	0	0	N
Mesoplodont beaked whales	California/Oregon/Washington	PAC	SWC	645	0.04	0.5	6.5	0	0	N
Cuvier's beaked whale	California/Oregon/Washington	PAC	SWC	1,121	0.04	0.5	11	0	0	N
Pygmy Sperm whale	California/Oregon/Washington	PAC	SWC	119	0.04	0.5	1	0	0	N
Sperm whale	California/Oregon/Washington	PAC	SWC	885	0.04	0.1	1.8	1.0	1.0	Y
Humpback whale	Eastern North Pacific	PAC	SWC	~~943~~ 1,158	0.08	0.1	~~1.6~~	~~≥ 1.2~~ ≥1.6	~~≥ 0.8~~ ≥1.2	Y
Blue whale	Eastern North Pacific	PAC	SWC	1,384	0.04	0.1	1.4	0.2	0	Y
Fin whale	California/Oregon/Washington	PAC	SWC	2,541	0.04	0.1	5.1	1.4	1.0	Y
Bryde's whale	California/Oregon/Washington	PAC	SWC	11,163	0.04	0.5	n/a	0	0	N
Sei whale	Eastern North Pacific	PAC	SWC	35	0.04	0.1	0.1	0	0	Y
Minke whale	California/Oregon/Washington	PAC	SWC	585	0.04	0.45	5.8	0	0	N
Rough-toothed dolphin	Hawaii	PAC	SWC	13,184	0.04	0.5	132	n/a	n/a	N
Risso's dolphin	Hawaii	PAC	SWC	1,426	0.04	0.5	14	n/a	n/a	N
Bottlenose dolphin	Hawaii	PAC	SWC	2,046	0.04	0.5	20	≥ 0.2	≥ 0.2	N

Information for stocks which were revised in 2005 appears shaded.

SUMMARY OF 2004 PACIFIC MARINE MAMMAL STOCK ASSESSMENT REPORTS

Species	Stock Area	Region	NMFS Center	N_{min}	R_{max}	F_r	PBR	Total Annual Mortality + Serious Injury	Annual Fishery Mortality + Serious Injury	Strategic Status
Pantropical spotted dolphin	Hawaii	PAC	SWC	7,362	0.04	0.5	59	≥ 0.8	≥ 0.8	N
Spinner dolphin	Hawaii	PAC	SWC	1,690	0.04	0.5	17	0	0	N
Striped dolphin	Hawaii	PAC	SWC	7,078	0.04	0.5	71	n/a	n/a	N
Fraser's dolphin	Hawaii	PAC	SWC	7,917	0.04	0.5	79	n/a	n/a	N
Melon-headed whale	Hawaii	PAC	SWC	1,386	0.04	0.5	14	n/a	n/a	N
Pygmy killer whale	Hawaii	PAC	SWC	382	0.04	0.5	3.8	n/a	n/a	N
False killer whale	Hawaii	PAC	SWC	128	0.04	~~0.5~~ 0.45	~~1.0~~ 1.2	~~6.8~~ 1.6[†]	~~6.8~~ 1.6[†]	Y
Killer whale	Hawaii	PAC	SWC	250	0.04	0.5	2.5	n/a	n/a	N
Pilot whale, short-finned	Hawaii	PAC	SWC	5,986	0.04	0.5	60	0.8	0.8	N
Blainville's beaked whale	Hawaii	PAC	SWC	1,204	0.04	0.5	9.6	0.8	0.8	N
Indopacetus pacificus	Hawaii	PAC	SWC	371	0.04	0.5	3.7	n/a	n/a	N
Cuvier's beaked whale	Hawaii	PAC	SWC	6,919	0.04	0.5	69	n/a	n/a	N
Pygmy sperm whale	Hawaii	PAC	SWC	4,082	0.04	0.5	41	n/a	n/a	N
Dwarf sperm whale	Hawaii	PAC	SWC	11,555	0.04	0.5	116	n/a	n/a	N
Sperm whale	Hawaii	PAC	SWC	5,531	0.04	0.1	11	n/a	n/a	Y
Blue whale	Hawaii	PAC	SWC	n/a	0.04	0.1	n/a	n/a	n/a	Y

Information for stocks which were revised in 2005 appears shaded.

SUMMARY OF 2004 PACIFIC MARINE MAMMAL STOCK ASSESSMENT REPORTS

Species	Stock Area	Region	NMFS Center	N_{min}	R_{max}	F_r	PBR	Total Annual Mortality + Serious Injury	Annual Fishery Mortality + Serious Injury	Strategic Status
Fin whale	Hawaii	PAC	SWC	101	0.04	0.1	0.2	n/a	n/a	Y
Sei whale	Hawaii	PAC	SWC	37	0.04	0.1	0.1	n/a	n/a	Y
Minke whale	Hawaii	PAC	SWC	n/a	0.04	0.5	n/a	n/a	n/a	N
Bryde's whale	Hawaii	PAC	SWC	373	0.04	0.5	3.7	n/a	n/a	N

† Serious injury and mortality values for the Hawaii stock of false killer whale includes only animals taken with the Hawaiian Islands Exclusive Economic Zone.